ZIAUDDIN UNIVERSITY
EXAMINATION BOARD

Higher Secondary School Certificate
(HSSC)

Examination syllabus

Physics
XII

Based on Provincial Revised Curriculum (Sindh)

You can approach us:

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PREFACE

The Ziauddin University Examination Board (ZUEB) was established under **Sindh ACT XLI 2018**, with the primary objective of enhancing the quality of education in Sindh. ZUEB is responsible for administering examinations for the **Secondary School Certificate (SSC)** and **Higher Secondary School Certificate (HSSC)** in alignment with the most recent revisions to the **National Curriculum**, as outlined by the **Directorate of Curriculum Assessment and Research (DCAR), Sindh**. Through its ordinance, ZUEB is mandated to provide examination services for both English, Urdu, and Sindhi medium candidates from private schools across Sindh. This examination syllabus reflects ZUEB's dedication to achieving the educational goals set by the provincial authorities.

In collaboration with subject professors, ZUEB has developed a comprehensive syllabus for each subject. It is important to distinguish between the syllabus and the curriculum. The syllabus serves as a guide for both teachers and students, outlining the key areas of focus within the subject. It provides students with a clear understanding of what is expected of them in their studies and helps them prepare effectively for their exams.

This examination syllabus incorporates all cognitive outcomes derived from the **Provincial Curriculum Statement**, ensuring that assessments are both valid and reliable. While the focus is primarily on the cognitive domain, significant emphasis is placed on the application of knowledge and understanding.

The syllabus is made available to all stakeholders via the ZUEB website to assist affiliated schools in planning their teaching. It is crucial to note that the syllabus, rather than the prescribed textbook, forms the foundation of ZUEB examinations. Additionally, this syllabus supports the development of learning materials for both students and teachers. ZUEB remains committed to supporting students undertaking the SSC and HSSC courses by facilitating their learning outcomes through this detailed syllabus document.

To further assist in the learning process, ZUEB provides a dedicated **e-resource tab** on its website, offering both text-based and video content on various subjects. These 15-20 minute instructional videos, created around key subject concepts, allow students to learn at their own pace and convenience. The videos can be used as a reinforcement tool to revisit lessons already taught or as pre-lesson material. This initiative is an ongoing effort, and new videos will continue to be uploaded.

We encourage all students and educators to make the most of these resources for a more enriched and flexible learning experience.

Sincerely,
Shahbaz Nasim
Head – Measurement & Testing
Ziauddin University Examination Board

Reviewed by:
Sana Anwer Ali
Manager Sciences
Ziauddin University Examination Board
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Rationale For The Reviewed Provincial Curriculum

The process of revising the National Curriculum 2006 began in August 2004, when the newly elected government of Pakistan initiated education reforms across the country. These reforms included the introduction of a new National Education Policy, a National Education Census, and a revision of curricula (Ministry of Education, 2009).

In practice, the overhaul of the secondary school curriculum began in 2006, leading to a review of the scheme of studies for classes I to XII and the revision of curricula for 25 compulsory subjects.

The 18th Amendment to the Constitution of Pakistan, enacted in 2010, significantly altered the federal- provincial relationship by abolishing the "concurrent legislative list." This amendment granted provinces greater legislative and financial autonomy in sectors such as education and health. The most notable implication of the 18th Amendment for education was the transfer of responsibility for curriculum development, syllabus planning, policy formation, and educational standards to the provinces, marking a significant step forward for education.

In Sindh, the School Education Department tasked a Curriculum Review Team with revising the National Curriculum 2006 for all subjects. The goal was to create a curriculum better suited to the needs of students and teachers while aligning with the principles of the 18th Amendment. Subject-specific curriculum review committees were established to critically examine and align the curriculum's content, both contextually and textually, ensuring coherence across various subjects. The Bureau of Curriculum (BoC) played a crucial role in organizing workshops and meetings in Hyderabad to facilitate the completion of this task. The support of numerous educationists, researchers, and teachers was invaluable in successfully revising the curriculum.

The revised National Curriculum, along with the original version, is available on the DCAR website at https://dcar.gos.pk/Sindh-Curriculum/Physics%20Curriculum%20Grades%20XI%20-XII,%20Notified%2025-11-2019.pdf for easy access.

The Ziauddin University Examination Board (ZUEB) SSC and HSSC syllabi are developed in accordance with the Sindh Revised Curriculum. To date, textbooks for various subjects have been developed based on the revised curriculum.

LIST OF SECTIONS GRADE – XII

SECTION	UNITS
THERMAL PHYSICS	15. Molecular Theory of Gases 16. First Law of Thermodynamics 17. Second Law of Thermodynamics
MAGNETISM	18. Magnetic Fields 19. Electromagnetic Induction 20. AC Circuits
ELECTRONICS	21. Physics of Solids 22. Solid State Electronics 23. Digital Electronic
MODERN PHYSICS	24. Relativity 25. Quantum Physics 26. Atomic Physics 27. Nuclear Physics 28. Particle Physics

UNIT-15 MOLECULAR THEORY OF GASES

Content	Students will be able to:	Cognitive level
15.1 Temperature	15.1.1 Recall concept of temperature. 15.1.2 Solve problems using scales of temperature and their conversion. 15.1.3 Explain triple point of water.	**K** **A** **U**
15.2 Gas Laws	15.2.1 State general gas law. 15.2.2 Derive gas laws (Boyle's law, Charle's law and Avogadro's law). 15.2.3 Solve problems using gas laws.	**K** **U** **A**
15.3 Kinetic Theory of Gases (KTG)	15.3.1 State the basic postulates of KTG. 15.3.2 Describe the molecular movement causes the pressure exerted by gas and derive pressure equation. 15.3.3 Describe the relation between kinetic energy of molecules and temperature. 15.3.4 Solve problems using relation between kinetic energy and temperature.	**K** **U** **U** **A**

UNIT-16 FIRST LAW OF THERMODYNAMICS

Content	Students will be able to:	Cognitive level
16.1 Heat and Work	16.1.1 Describe that heat flow and work are two forms of energy transfer between systems and calculate heat being transferred.	**U**
16.2 Internal Energy	16.2.1 Relate rise in temperature of a system increases its internal energy. 16.2.2 Explain that internal energy is determined by the state of the system and that it can be expressed as the sum of the random distribution of kinetic and potential energies associated with the molecules of the system.	**U** **U**

16.3 First Law of Thermodynamics and its Applications	16.3.1 Define thermodynamics and various terms associated with it. 16.3.2 Calculate work done by a thermodynamic system during a volume change. 16.3.3 Describe the first law of thermodynamics expressed in terms of the change in internal energy, the heating of the system	**K** **U** **U**
	and work done on the system. 16.3.4 Explain that first law of thermodynamics expresses the conservation of energy. 16.3.5 Describe the applications of first law of thermodynamics with the help of equations and graphs. 16.3.6 Solve the problems using the equations of first law of thermodynamics.	**K** **A** **A**
16.4 Molar Specific Heat	16.4.1 Define the terms specific heat and molar specific heats of a gas. 16.4.2 Apply first law of thermodynamics to derive Cp – Cv = R. 16.4.3 Solve the problems using equations of specific heat.	**K** **A** **A**

UNIT-17 SECOND LAW OF THERMODYNAMICS

Content	Students will be able to:	Cognitive level
17.1 Second Law of Thermodynamics	17.1.1 State and explain second law of thermodynamics.	**U**
17.2 Heat Engines	17.2.1 State the working principle of heat engine. 17.2.2 Describe the concept of reversible and irreversible processes. 17.2.3 Describe the working of petrol engine and diesel engine.	**U** **U** **K**
17.3 Carnot Cycle	17.3.1 Explain the working principle of Carnot's engine. 17.3.2 Explain that the efficiency of a Carnot engine is independent of the nature of the working substance and depends on the temperatures of hot and cold reservoirs. 17.3.3 Solve problems to find out the efficiency of heat engine.	**U** **U** **A**

17.4 Refrigerator	17.4.1 Describe that refrigerator is a heat engine operating in reverse as that of an ideal heat engine and find its efficiency. 17.4.2 Solve problems to find out the efficiency of a refrigerator.	**U** **A**
17.5 Entropy	17.5.1 Describe that change in entropy is positive when heat is added and negative when heat is removed from the system. 17.5.2 Explain that increase in entropy means degradation of energy. 17.5.3 Show that energy is degraded during all-natural processes. 17.5.4 Identify that system tend to become less orderly over time. 17.5.5 Solve problems using the equation of entropy.	**U** **U** **K** **A** **A**

UNIT-18 MAGNETIC FIELDS		
Content	**Students will be able to:**	**Cognitive level**
18.1 Magnetic Field of Current–carrying Conductor	18.1.1 Describe that a magnetic field is an example of a field of force produced either by current-carrying conductors or by permanent magnets. 18.1.2 Describe and sketch field lines pattern due to a long straight wire.	**U** **U**
18.2 Magnetic Force on a Current-carrying Conductor	18.2.1 Describe the factors affecting the force on a current carrying conductor in a magnetic field. 18.2.2 Solve problems using the equation $F=BIL\sin\Theta$, with directions as interpreted by Fleming's left-hand rule.	**U** **A**
18.3 Magnetic Flux Density	18.3.1 Define magnetic flux density and the Tesla. 18.3.2 Understand how the force on a current-carrying conductor can be used to measure the flux density of a magnetic field using a current balance. 18.3.3 Describe the concept of magnetic flux (Ø) as scalar product of magnetic field (B) and area (A) using the relation $Ø_B = B.A$. 18.3.4 Solve the problems using $Ø_B = B.A$	**K** **U** **U** **A**

18.4	**Ampere's Law and its Applications**	18.4.1 State and explain Amperes law. 18.4.2 Explain solenoid and toroid Solve problems to obtain Magnetic flux density of solenoid and toroid by amperes law $B = \mu_o I/2\pi r$ and $B = \mu_o NI$	**U** **A**
18.5	**Force on a Moving Charged Particle in a Uniform Magnetic Field**	18.5.1 Explain that a force acts on a charged particle in a uniform magnetic field. 18.5.2 Solve problems using $F = qvB\sin\Theta$ 18.5.3 Describe a method to measure the e/m of an electron by applying magnetic field and electric field on a beam of electrons. 18.5.4 Describe the motion of electrons in an electric field and magnetic field using a Cathode Ray tube. 18.5.5 Solve problems using related equations	**U** **A** **U** **U** **A**
18.6	**Torque on a Current Carrying Coil in a Magnetic Field**	18.6.1 Understand the turning effect on a current carrying coil in a magnetic field. 18.6.2 Derivation and use of $\tau = BANI$.	**U** **A**
18.7.	**Electro-mechanical Instruments**	18.7.1 Describe the construction and working of Galvanometer and Its conversion into Voltmeter, Ammeter and Avometer. 18.7.2 Solve problems using $R_x = (\frac{V}{I_g}) - R_g$ $R_s = (\frac{I_g}{I - I_g})\, R_g$	**A** **A**

UNIT-19 ELECTROMAGNETIC INDUCTION		
Content	**Students will be able to:**	**Cognitive level**
19.1 Faraday's Law	19.1.1 Describe the production of electricity by magnetism. 19.1.2 Explain that induced emf's can be generated in two ways. (i) by relative movement (the generator effect). (ii) by changing a magnetic field (the transformer effect). 19.1.3 Infer the factors affecting the magnitude of the induced emf. 19.1.4 State Faraday's law of electromagnetic induction. 19.1.5 Account for Lenz's law to predict the direction of an induced current and relate to the principle of conservation of energy. 19.1.6 Apply Faraday's law of electromagnetic induction and Lenz's law to solve problems.	**U** **U** **U** **K** **U** **A**
19.2 Eddy Currents	19.2.1 Explain the production of eddy currents and identify their magnetic and heating effects. 19.2.2 Explain the need for laminated iron cores in electric motors, generators and transformers.	**U** **K**
19.3 Self-Induction	19.3.1 Define Self Induction and its unit. 19.3.2 How an inductor is used to store electric potential energy? 19.3.3 Derive energy produced in Self Induction is $E = ½ Li^2$	**K** **K** **A**

19.4 Mutual Inductance	19.4.1 Explain Mutual Inductance (M) and its unit henry. 19.4.2 Describe the construction of a transformer and explain how it works. 19.4.3 Identify the relationship between the ratio of the number of turns in the primary and secondary coils and the ratio of primary to secondary voltages. 19.4.4 Recall that how step up and step-down transformers can be used to ensure efficient transfer of electricity along cables. 19.4.5 Describe the use of step-down and step-up transformers for the electric supply from power station to houses and electric appliances at home. 19.4.6 Solve problems using $\frac{N_S}{N_P} = \frac{V_S}{V_P}$	**U** **U** **A** **K** **K** **A**
19.5 Motional emf and A.C.Generator	19.5.1 Define motional emf. 19.5.2 Compute the potential difference across ends of a given rod or wire moving through a magnetic field. 19.5.3 Explain construction and working of an AC generator. 19.5.4 Identify the factors affecting induced EMF of an AC generator. 19.5.5 Solve problems using $\xi = \xi_0 \sin 2\pi ft$.	**K** **U** **U** **U** **U**
19.6 A.C. Motor and Back emf	19.6.1 Describe the main features of an A.C motor and the role of each feature. 19.6.2 Explain the production of back emf in electric motors.	**U** **U**

UNIT-20 AC CIRCUITS

Content	Students will be able to:	Cognitive level
20.1 Alternating Current	20.1.1 Define the terms time period, frequency, instantaneous peak value and root mean square value of an alternating current and voltage. 20.1.2 Represent a sinusoidal alternating current or voltage by an equation of the form $x = x_o \sin \omega t$. 20.1.3 Describe the phase of A.C and how phase lags and leads in A.C Circuits.	**K** **A** **U**

20.2 A C through Resistor	20.2.1 Explain the flow of A.C through Resistors. 20.2.2 Calculate the resistance of resistors. 20.2.3 Construct phasor diagrams and carry out calculations on circuits including resistive Components.	**U** **U** **A**
20.3 A C through Capacitor	20.3.1 Explain the flow of A.C through capacitors. 20.3.2 Calculate the reactance of capacitors. 20.3.3 Construct phasor diagrams and carry out calculations on circuits including reactive components.	**U** **A** **A**
20.4 A C through Inductor	20.4.1 Explain Ac through inductors. 20.4.2 Identify inductors as important components of A.C circuits termed as chokes. 20.4.3 Construct phasor diagrams and carry out calculations on circuits including inductive Components.	**U** **K** **A**
20.5 RLC Circuits	20.5.1 Describe impedance as vector summation of resistances and reactance. 20.5.2 Construct phasor diagrams and carry out calculations on circuits including resistive reactive and inductive components in series and parallel. 20.5.3 Solve the problems using the formulae of A.C Power. 20.5.4 Explain resonance in an A.C circuit and carry out calculations using the resonant frequency formulae. 20.5.5 Describe that maximum power is transferred when the impedances of source and load match to each other. 20.5.6 Illustrate the principle of metal detectors used for security checks. 20.5.7 State the principle of electro-cardiograph in medical diagnostic. 20.5.8 Describe the importance of oscillator circuit as broadcaster of radio waves. 20.5.9 Describe the principle of resonance in tuning circuits of a radio. 20.5.10 Solve problems using Equations of RC, RL, LC, RLC circuits in series and parallel $Z_{RC} = \sqrt{R^2 + \frac{1}{(\omega C)^2}}$ $Z_{RL} = \sqrt{R^2 + (\omega L)^2}$ $f_R = \frac{1}{2\pi\sqrt{LC}}$	**U** **A** **A** **U** **U** **K** **K** **U** **U** **A**

UNIT- 21 PHYSICS OF SOLIDS		
Content	**Students will be able to:**	**Cognitive level**
21.1 Classification of Solids	21.1.1 Distinguish between the structure of crystalline, glassy, amorphous and polymeric solids. 21.1.2 Describe that deformation in solids is caused by a force and that in one dimension; the deformation can be tensile or compressive.	**U** **U**
21.2 Mechanical Properties of Solids	21.2.1 Define and use the terms Young's modulus, bulk modulus and shear modulus. 21.2.2 Demonstrate the force-extension graphs for typical ductile, brittle and polymeric materials. 21.2.3 Become familiar ultimate tensile stress, elastic deformation and plastic deformation of a material.	**K** **U** **K**
21.3 Electrical Properties of Solids	21.3.1 Describe the idea about energy bands in solids. 21.3.2 Classify insulators, conductors, and semiconductors on the basis of energy bands. 21.3.3 Become familiar with the behavior of superconductors and their potential uses. 21.3.4 Describe the applications of superconductors in magnetic resonance imaging (MRI), magnetic levitation trains, powerful but small electric motors and faster computer chips.	**U** **U** **K** **U**
21.4 Magnetic Properties of Solids	21.4.1 Distinguish between diamagnetic, paramagnetic and ferromagnetic materials. 21.4.2 Describe the concepts of magnetic domains in a material. 21.4.3 Explain the Curie point. 21.4.4 Classify hard and soft ferromagnetic substances. 21.4.5 Describe hysteresis loss. 21.4.6 Synthesis from hysteresis loop how magnetic field strength varies with magnetizing current. 21.4.7 Identify the importance of hysteresis loop to select materials for their use to make them temporary magnets or permanent magnets.	**U** **U** **K** **K** **U** **U** **A**

UNIT-22 SOLID STATE ELECTRONICS		
Content	**Students will be able to:**	**Cognitive level**
22.1 P and N type Substance	22.1.1. Differentiate between intrinsic (pure) and doped semiconductors	**U**
	22.1.2. How the n-type and p-type semiconductors are produced.	**K**
	22.1.3. Explain the concept of holes and electrons in semiconductors.	**U**
22.2 PN Junction	22.2.1 Explain how electrons and holes flow across a junction.	**K**
	22.2.2 Describe a PN junction(diode).	**U**
	22.2.3 Discuss its forward and reverse biasing.	**U**
	22.2.4 Describe the I-V characteristic curves of PN junction.	**A**
	22.2.5 Define rectification and describe the use of diodes for half and full wave rectifications.	**U**
	22.2.6 Describe the function and use of LED, Photodiode and Photo voltaic cell.	**U**
22.3 Transistor and Its Characteristics	22.3.1 Distinguish between PNP & NPN transistors.	**K**
	22.3.2 Describe the operations of transistors.	**U**
	22.3.3 Deduce current equation and apply it to solve problems on transistors.	**U**
	22.3.4 Apply operation principles of the transistor including I-V characteristics and biasing methods.	**A**
	22.3.5 Explain the use of transistors as a switch and an amplifier (common-emitter).	**U**
	22.3.6 Explain common-base and common collector configurations.	**U**
22.4 OP amplifier	22.4.1 Describe the properties of an ideal operational amplifier.	**U**
	22.4.2 Express operational amplifier as a comparator.	**U**
	22.4.3 Understand the effects of negative feedback on the gain of an operational amplifier.	**A**
	22.4.4 Draw the circuit diagrams for both the inverting and the non-inverting amplifier for single signal input.	**U**
	22.4.5 Understand the virtual earth approximation.	**U**
	22.4.6 Express for the gain of inverting amplifiers.	**U**
	22.4.7 Recall and use expressions for the voltage gain of inverting and of non-inverting Amplifiers.	**K**

UNIT-23 DIGITAL ELECTRONICS		
Content	**Students will be able to:**	**Cognitive level**
23.1 Digital Signal Levels	23.1.1 Explain signal levels employed in digital electronics or circuits are 'high' (for example, +5 volts) and 'low' (for example, 0 volts) 23.1.2 Describe the 'high' and 'low' states are referred to as '1' and '0' for open and close circuit respectively..	**U** **U**
23.2 Logic Gates	23.2.1 Recall electronic symbols of the logic gates AND, OR, NOT, NOR, NAND, XOR. 23.2.2 Use logic gates (AND, OR, NOT, NOR, NAND, XOR, combinations) and their truth tables for 2, 3 and 4 inputs. 23.2.3 Identify the behavior of a 2 inputs AND gate and a 2 inputs OR gate with simple circuit using 2 switches, a lamp and a battery.	**K** **U** **A**

UNIT-24 RELATIVITY		
Content	**Students will be able to:**	**Cognitive level**
24.1 Frame of References	24.1.1 Describe Relative Motion with suitable examples (same and opposite direction). 24.1.2 Distinguish between inertial and non-inertial frames of reference. 24.1.3 Predict the motion of an object relative to a different frame of reference e.g. dropping a ball in a moving vehicle observed from the vehicle and by a person standing on the side walk.	**U** **K** **A**
24.2 Special Theory of Relativity	24.2.1 Analyze and evaluate the evidence confirming or denying Einstein's two postulates. 24.2.2 Identify that if c is constant then space and time become relative. 24.2.3 Explain qualitatively and quantitatively the consequence of special relativity in relation to the relativity of simultaneity length contraction time dilation mass increase the equivalence between mass and energy. 24.2.4 Discuss the limitation on the maximum	**A** **K** **U**

	velocity of a particle imposed by special relativity.	**U**
	24.2.5 Explain the implications of mass increase, time dilation and length contraction for space travel.	**U**
	24.2.6 Identify the role of special theory of relativity in global positioning, NAVSTAR system.	**K**
	24.2.7 Solve problems using □ $=t_0/\sqrt{1-V^2/C^2}$ and $l=l_0\sqrt{1-V^2/C^2}$ $m=m_0/\sqrt{1-V^2/C^2}$ $E=mc^2$	**A**
24.3 General Relativity	25.3.1 Describe the general relativity. 25.3.2 Understand gravity as space time continuum.	**U** **U**

UNIT-25 QUANTUM PHYSICS		
Content	**Students will be able to:**	**Cognitive level**
25.1 Quantum Theory of Radiation	25.1.1 Describe the concept of black body radiation. 25.1.2 Describe how energy is distributed over the wavelength range for several values of source temperature. 25.1.3 Describe the Planck's hypothesis that radiation emitted and absorbed by the walls of a black body cavity is quantized. 25.1.4 Elaborate the particle nature of electromagnetic radiation. 25.1.5 Solve problems using $E=\frac{hc}{\lambda}$	**U** **U** **U** **U** **U**
25.2 Photoelectric Effect	25.2.1 Describe the phenomenon of photoelectric effect. 25.2.2 Explain Photoelectric Effect on the basis of quantum theory. 25.2.3 Solve problems using $hf-\varphi=\frac{1}{2}mv^2$ 25.2.4 Identify data sources, gather, process and present information to summarize the use of the photoelectric effect in solar cells & photocells.	**U** **U** **U** **K**

25.3 Compton Effect	25.3.1 Explain the particle model of light in terms of photons with particular energy and frequency. 25.3.2 Describe Compton effect qualitatively. 25.3.3 Solve problems using $\Delta\lambda = \frac{h}{m_0 c}(1 - \cos\theta)$	**U** **U** **U**
25.4 Pair Production	25.4.1 Explain the process of pair production on the basis of conservation Laws.	**U**
25.5 Annihilation of Matter	25.5.1 Describe conservation laws in the annihilation of matter.	**U**
25.6 Wave nature of particles	25.6.1 Describe the impact of de Broglie's proposal that any kind of particle has both wave and particle properties. 25.6.2 Describe the confirmation of de Broglie's proposal by Davisson and Germer experiment in which the diffraction of electrons by the surface layers of a crystal lattice was observed. 25.6.3 Explain how the very short wavelength of electrons, and the ability to use electrons and magnetic fields to focus them, allows electron microscope to achieve very high resolution. 25.6.4 Search and describe the role of electron microscope to study the micro structures and properties of matter.	**U** **U** **U** **K**
25.7 Uncertainty Principle	25.7.1 Describe uncertainty principle.	**K**

UNIT-26 ATOMIC PHYSICS		
Content	**Students will be able to:**	**Cognitive level**
26.1 Atomic Spectra	26.1.1 Describe and explain the origin of different types of optical spectra. 26.1.2 Show an understanding of the existence of discrete electron energy levels in isolated atoms (e.g. atomic hydrogen) and deduce how this leads to spectral lines. 26.1.3 Explain how the uniqueness of the spectra of elements can be used to identify an element.	**U** **U** **K**

26.2 Bohr Model	26.2.1 Describe Bohr's postulates of Hydrogen atom. 26.2.2 Derive an expression for quantized radii. 26.2.3 Explain hydrogen atom in terms of energy levels on the basis of Bohr Model. 26.2.4 Determine the ionization energy and various excitation energies of an atom using energy level diagram. 26.2.5 Illustrate the significance of the hydrogen spectrum in the development of Bohr's model of the atom. 26.2.6 Derive $1/\lambda = R_H [1/p2 – 1/n2]$. 26.2.7 Solve problems using $1/\lambda = R_H [1/p^2 – 1/n^2]$.	**U** **A** **A** **U** **A** **A** **A**
26.3 X-Rays	26.3.1 Describe inner shell transitions. 26.3.2 Explain production and characteristics of X-rays based on inner shell transition. 26.3.3 Describe properties and uses of X-rays.	**U** **U** **K**
26.4 Laser	26.4.1 Explain the terms spontaneous emission, stimulated emission, meta stable states, population inversion and laser action. 26.4.2 Describe the structure and purpose of the main components of a He-Ne gas laser. 26.4.3 Identify the useful properties of laser light and give some examples of their uses. 26.4.4 Identify the measures requirement for safe handling of lasers.	**U** **U** **U** **K**

UNIT-27 NUCLEAR PHYSICS

Content	**Students will be able to:**	**Cognitive level**
27.1 Isotopes	27.1.1 Recall the composition of atomic nuclei. 27.1.2 Describe isotopes in detail. 27.1.3 Explain that an element can exist in various isotopic forms each with a different number of neutrons. 27.1.4 Explain the use of mass spectrograph to demonstrate the existence of isotopes and to measure their relative abundance.	**K** **U** **U** **U**

27.2 Radioactive Decay	27.2.1 Explain the process of radioactive decay. 27.2.2 State law of radioactive decay. 27.2.3 Identify the spontaneous and random nature of nuclear decay. 27.2.4 Define the terms activity and decay constant 27.2.5 Solve problems using $A = \lambda N$ 27.2.6 Infer and sketch the exponential nature of radioactive decay. 27.2.7 Describe the term half-life and solve problems using the equation $\lambda=0.693/T_{1/2}$.	**U** **K** **U** **K** **A** **A** **A**
27.3 Mass Defect and Binding Energy	27.3.1 Define the terms unified mass scale, mass defect and calculate binding energy using Einstein's equation. 27.3.2 Illustrate graphically the variation of binding energy per nucleon with the mass number.	**U** **A**
27.4 Nuclear Reactions	27.4.1 Determine the release of energy from different nuclear reactions. 27.4.2 Explain that atomic number and mass number conserve in nuclear reactions. 27.4.3 Describe energy and mass conservation in simple reactions and in radioactive decay. 27.4.4 Describe the phenomena of nuclear fission and fusion. 27.4.5 Describe the fission chain reaction 27.4.6 Describe the function of various components of a nuclear reactor. 27.4.7 Explain the basic principle of nuclear reactor. 27.4.8 Describe how the conditions in the interiors of the Sun and other stars allow nuclear fusion to take place and hence, how nuclear fusion is their main energy conversion process.	**U** **U** **U** **U** **U** **U** **U** **U**
27.5 Radiation Exposure	27.5.1 Show awareness about nuclear radiation exposure and biological effects of radiation. 27.5.2 Describe the term dosimetry. 27.5.3 Describe the use of radiations for medical diagnosis and therapy. 27.5.4 Explain the importance of limiting exposure to ionizing radiation. 27.5.5 Describe the examples of the use of radioactive tracers in medical diagnosis, agriculture and industry.	**K** **K** **U** **U** **U**

UNIT-28 PARTICLE PHYSICS		
Content	**Students will be able to:**	**Cognitive level**
28.1 The Standard Model	29.1.1. Describe the fundamental forces of nature and their field particles. 29.1.2. Describe the key features and components of the standard model of matter including hadrons, leptons and quarks.	**U** **U**
28.2 Radiation Detectors	28.2.1 Describe the working principal, construction and use of Wilson Cloud Chambers. 28.2.2 Describe the working principal, construction and use of GM counter.	**U** **U**

Ziauddin University Examination Board
Scheme of Assessment

Maximum marks: 100

Section "A"

Multiple Choice Questions (MCQs) **(17 x 1 = 17)**
Attempt 17 MCQs. Each MCQ carries equal marks.

Practical based Assessments (PBAs) **(15 x 1 = 15)**
Attempt 15 MCQs. Each MCQ carries equal marks.

Section "B"

Short Answer Questions **(9 x 4 = 36)**
Attempt any 9 out of 12 questions. Each question carries equal marks.

Section "C"

Detailed Answer Questions **(2 x 16 = 32)**
Attempt any 2 (with sub-parts) out of 3 questions.
Each question has 2 sub parts of 8 and 8 marks respectively.

Ziauddin University Examination Board
Physics
Table of Specification [TOS]

S.No	Domains	Weightage in evaluation 100%	MCQs 1 mark each	PBAs 1 mark each	Short Answers 4 marks each	Detailed Answers 8 marks for each sub-part
1	Molecular Theory of Gases	5%	2	3	1	–
2	First Law of Thermodynamics	8%	2	–	1	1
3	Second Law of Thermodynamics	9%	1	2	–	1
4	Magnetic Fields	9%	1	–	1	–
5	Electromagnetic Induction	9%	2	1	1	–
6	Alternating Currents [Circuits]	7%	1	–	1	1
7	Physics of Solids	4%	1	–	1	1
8	Solid State of Electronics	8%	1	4	–	1
9	Digital Electronics	4%	1	1	1	1
10	Relativity	5%	1	1	1	–
11	Quantum Physics	10%	1	2	1	–
12	Atomic Physics	10%	1	1	1	–
13	Nuclear Physics	4%	1	–	1	–
14	Particle Physics	4%	1	–	1	–
Total # of Questions asked			**17**	**15**	**12**	**3 (with 2 sub parts each of 8 marks)**
Total # of Questions to be attempted			**17**	**15**	**9**	**2 (with sub parts)**
Maximum marks attainable			**17 marks**	**15 marks**	**36 marks**	**32 marks**

DEFINITIONS OF COGNITIVE LEVELS

Remember

Remembering is the act of retrieving knowledge and can be used to produce things like definitions or lists. The student must be able to recall or recognise information and concepts. The teacher must present information about a subject to the student, ask questions that require the student to recall that information and provide written or verbal assessment that can be answered by remembering the information learnt.

Question Stems

- Can you name all the …?
- Describe what happens when …?
- How is (are) …?
- How would you define …?
- How would you identify …?
- How would you outline …?
- How would you recognise…?
- List the … in order.
- What do you remember about …?
- What does it mean?
- What happened after?
- What is (are) …?
- What is the best one?
- What would you choose …?
- When did …?
- Where is (are) …?
- Which one …?
- Who spoke to …?
- Who was …?
- Why did …?

Understand

The next level in the taxonomic structure is Understanding, which is defined as the construction of meaning and relationships. Here the student must understand the main idea of material heard, viewed, or read and interpret or summarise the ideas in their own words. The teacher must ask questions that the student can answer in their own words by identifying the main idea.

Question Stems

- Can you clarify…?
- Can you illustrate …?
- Condense this paragraph.
- Contrast …
- Does everyone think in the way that … does?
- Elaborate on …
- Explain why …
- Give an example
- How can you describe...?
- How would you clarify the meaning...?
- How would you compare …?
- How would you differentiate between …?
- How would you describe…?
- How would you generalise…?
- How would you identify …?
- Is it valid that …?
- Is this the same as …?
- Outline …
- Select the best definition...
- State in your own words...
- This represents …
- What are they saying?
- What can you infer from …?
- What can you say about …?
- What could have happened next?
- What did you observe?

	• What does this mean? • What expectations are there? • What information can you infer from…? • What is the main idea of …? • What restrictions would you add? • What seems likely? • What seems to be …? • What would happen if …? • What might happen if …? • Which are the facts? • Which statements support …?
Apply The third level in Bloom's taxonomy, Applying, marks a fundamental shift from the pre-Bloom's learning era because it involves remembering what has been learnt, having a good understanding of the knowledge, and applying it to real-world exercises, challenges or situations. Students must apply an abstract idea in a concrete case to solve a problem or relate it to prior experience. The teacher must provide opportunities for students to use theories and problem-solving techniques in new situations and review and check their work. Assessment questions should be provided that allow students to define and solve problems. **Question Stems** • Can you group by characteristics such as …? • Choose the best statements that apply... • Clarify why … • Do you know of another instance where …? • Draw a story map... • Explain why a character acted in the way that he did... • From the information given, can you develop a set of instructions about …? • How would you develop …? • How would you change …? • How would you demonstrate…?	**Analyse** Analysing is the cognitive level where students can take the knowledge they have remembered, understood and applied, then delve into that knowledge to make associations, discernments or comparisons. Students should break down a concept or idea into parts and show relationships between these parts. Teachers must give students time to examine concepts and their requisite elements. Students are required to explain why they chose a solution. **Question Stems** • Can you distinguish between …? • Can you explain what must have happened when …? • Determine the point of view, bias, values, or intent underlying the presented material... • Discuss the pros and cons of … • How can you classify … according to …? • How can you compare the different parts? • How can you sort the different parts…? • How is … connected to …? • How is … similar to …? • How would you categorise…? • How would you explain...?

• How would you develop? • How would you explain …? • How would you modify …? • How would you present…? • How would you solve … ? • Identify the results of … • Illustrate the … • Judge the effects of … What would result …? • Predict what would happen if … • Tell how much change there would be if … • Tell what would happen if … • What actions would you take to perform …? • What do you think could have happened next? • What examples can you find that ? • What other way would you choose to …? • What questions would you ask of …? • What was the main idea …? • What would the result be if …? • Which factors would you change if …? • Who do you think…? • Why does this work? • Write a brief outline … • Write in your own words …	• What could the ending have been if ... had taken place? • State the point of view of … • What are some of the problems of …? • What assumptions …? • What can you infer about…? • What can you point out about ? • What conclusions …? • What do you see as other possible outcomes? • What does the author assume? • What explanation do you have for …? • What ideas justify the conclusion? • What ideas validate…? • What is the analysis of …? • What is the function of …? • What is the problem with …? • What motive is there? • What persuasive technique is used? • What statement is relevant? • What was the turning point? • What were some of the motives behind …? • What's fact? Opinion? • What's the main idea? • What's the relationship between? • Which events could not have happened? • Why did … changes occur? • Why do you think ?

BLOOM'S TAXONOMY WITH EXAMPLES

If you are a teacher looking for ways to engage your students in learning, this LIST of questions might be interesting for your classroom practice. Bloom's Taxonomy question stems can help elicit higher-order thinking skills and promote critical thinking among learners at different taxonomy levels. These question stems can also encourage students to think about their knowledge through reflection before answering questions.

ACTION WORDS FOR COGNITIVE LEVELS

Knowledge	Understand	Apply	Analyze	Evaluate	Create
					
define	explain	solve	analyze	reframe	design
identify	describe	apply	appraise	criticize	compose
describe	interpret	illustrate	judge	evaluate	create
label	paraphrase	modify	support	order	plan
list	summarize	use	compare	compare	combine
name	classify	calculate	decide	classify	formulate
state	compare	change	discriminate	contrast	invent
match	differentiate	choose	recommend	distinguish	hypothesize
recognize	discuss	demonstrate	summarize	infer	substitute
select	distinguish	discover	assess	separate	write
examine	extend	experiment	choose	explain	compile
locate	predict	relate	convince	select	construct
memorize	associate	show	defend	categorize	develop
quote	contrast	sketch	estimate	connect	generalize
recall	convert	complete	grade	differentiate	integrate
reproduce	demonstrate	construct	measure	divide	modify
tabulate	estimate	dramatize	predict	order	organize
tell	express	interpret	rank	prioritize	prepare
Copy	identify	manipulate	score	survey	produce

discover	indicate	paint	select	calculate	rearrange
duplicate	infer	prepare	test	conclude	rewrite
enumerate	relate	teach	argue	correlate	adapt
listen	restate	act	conclude	deduce	anticipate
observe	select	collect	consider	devise	arrange
omit	translate	compute	critique	diagram	assemble
read	ask	explain	debate	dissect	choose
recite	cite	list	distinguish	estimate	collaborate
record	discover	operate	editorialize	evaluate	facilitate
repeat	generalize	practice	justify	experiment	imagine
retell	group	simulate	persuade	focus	intervene
visualize	illustrate	transfer	rate	illustrate	make
	judge	write	weigh	organize	manage
	observe			outline	originate
	order			plan	propose
	report			question	simulate
	represent			test	solve
	research				support
	review				test
	rewrite				validate
	show				

HSSC PART II EXAMINATION
MARKS BREAKUP GRID FOR EXAMINATION 2025

GROUP: PRE-MEDICAL

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / URDU EASY	100	-	100
ISLAMIYAT / ETHICS	50	-	50
PHYSICS	85	15	100
CHEMISTRY	85	15	100
BIOLOGY	85	15	100
TOTAL	505	45	550

GROUP: PRE-ENGINEERING

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / URDU EASY	100	-	100
ISLAMIYAT / ETHICS	50	-	50
PHYSICS	85	15	100
CHEMISTRY	85	15	100
MATHEMATICS	100	--	100
TOTAL	520	30	550

GROUP: GENERAL SCIENCE

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / URDU EASY	100	-	100
ISLAMIYAT / ETHICS	50	-	50
PHYSICS	85	15	100
COMPUTER SCIENCE	75	25	100
MATHEMATICS	100	--	100
TOTAL	510	40	550

GROUP: COMMERCE

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / URDU EASY	100	-	100
ISLAMIYAT / ETHICS	50	-	50
ECONOMICS	75	-	75
P.O.C	75	-	75
ACCOUNTING	100	--	100
BUSINESS MATHEMATICS	50		50
TOTAL	550	---	550

GROUP: HUMANITIES

(Any Three Electives)

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / URDU EASY	100	-	100
ISLAMIYAT / ETHICS	50	-	50
COMPUTER SCIENCE	75	25	100
ISLAMIC STUDIES	100		100
MATHEMATICS	100	-	100
SOCIOLOGY	100	--	100
ECONOMICS	100		100
EDUCATION	100		100
CIVICS	100		100
NURSING	85	15	100
TOTAL	550	---	550

GROUP: MEDICAL TECHNOLOGY

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / URDU EASY	100	-	100
ISLAMIYAT / ETHICS	50	-	50
MICROBIOLOGY	85	15	100
HEMATOLOGY & BLOOD BANKING	85	15	100
ANATOMY & PHYSIOLOGY	85	15	100
TOTAL	505	45	550