ASSESSMENT FRAMEWORK AND MODEL QUESTION PAPER

PHYSICS

Grade X

NATIONAL CURRICULUM OF PAKISTAN
2022-23

SCHEME OF STUDIES 2006

FEDERAL BOARD
OF INTERMEDIATE AND SECONDARY
EDUCATION, ISLAMABAD

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FEDERAL BOARD OF INTERMEDIATE AND SECONDARY EDUCATION
H-8/4, ISLAMABAD

ASSESSMENT FRAMEWORK

FOR

PHYSICS GRADE-X

CURRICULUM 2022-23

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ACKNOWLEDGEMENT

It is a great honour that we, at Federal Board of Intermediate and Secondary Education, have developed the Assessment Framework (AF) for the subject of Physics for Grade-X. The primary objective of the AF is to optimize the current curriculum 2022-23. This comprehensive framework has been crafted meticulously by subject matter and assessment experts who conducted an in-depth review of all learning outcomes for Grade-X Physics curriculum. They evaluated these outcomes in terms of their scope, cognitive level, and progression across the grade.

This significant undertaking was the result of a series of extensive meetings and collaborative efforts of the subject and assessment experts. Their dedication and expertise have been instrumental in bringing this framework to fruition.

The Assessment Framework will serve as a guiding document for students, teachers and paper setters. Students will receive clear directions for preparing themselves for the annual examination. Similarly, teachers will use it as a guide to understand what to teach in class and to prepare students for the final examinations accordingly. Similarly paper setters will also seek guidance from this document.

Following subject as well as assessment experts/committee members remained constantly engaged in the development of the AF:

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The whole work was successfully accomplished under the able supervision and guidance of Dr Ikram Ali Malik, Chairman, FBISE and due to the hard work and dedication of the staff of Research Section of FBISE, in particular, Syed Zulfiqar Shah, Deputy Secretary, Research and Academics who played a pivotal and leading role in finalizing the Assessment Framework.

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ASSESSMENT FRAMEWORK FOR PHYSICS GRADE-X, CURRICULUM 2022-23

To ensure clarity and precision in assessment, the learning outcomes have been categorized into two distinct groups: formative and summative. This classification helps in effectively measuring student progress and understanding. Each Student learning outcome (SLO) has been carefully marked as either formative or summative within the newly developed Assessment Framework. SLOs of Summative Assessment Format will be part of the Final Examination while SLOs of Formative Assessment will although be part of the teaching-learning activity but they will **NOT** be part of Final Examinations. Estimated cognitive levels i.e Knowledge (K), Understanding (U) and Application (A) of all the SLOs have also been indicated. It may be noted that all the higher cognitive levels have been collectively accumulated in the cognitive level of 'Application'. In subjects involving Practicals (Lab work), it has been mentioned categorically whether an SLO is summative for theory or summative for Practical Based Assessment (PBA). If an SLO is summative for PBA, it means that Laboratory work is required in the teaching-learning activity and it will be part of the Practical Examination/ Practical Based Assessment.

The Assessment Framework will act as a comprehensive guide for students, teachers and paper setters. Students will have clear instructions on how to prepare for the annual examinations. Teachers will use the framework to understand the curriculum and effectively prepare their students for the final examination. Additionally, paper setters will refer to this document for guidance in setting examination papers.

A model question paper has also been developed to provide a clear structure and format for upcoming examinations. The model question paper ensures consistency and fairness, offering students a comprehensive understanding of what to expect in their examinations. By aligning the paper with the Student Learning Outcomes (SLOs) of the curriculum, we ensured that the questions accurately reflect the skills and knowledge that students are expected to acquire.

A detailed Table of Specifications (ToS) has been created to ensure equitable coverage of cognitive levels and content domains in order to generate a balanced question paper. The ToS serves as drawing scale and action plan for the question paper, ensuring that all important areas of the curriculum are adequately and proportionately assessed.

FORMATIVE ASSESSMENT: AN ESSENTIAL COMPONENT OF EFFECTIVE LEARNING

Formative assessment is a pivotal element in the educational process, distinguished by its role in providing ongoing feedback to both students and educators. Unlike summative assessments, which evaluate student learning at the end of an instructional period, formative assessments are integrated into the learning process to monitor student understanding and guide instructional decisions.

The primary objective of formative assessment is to identify learning gaps and misunderstandings as they occur, enabling timely interventions. This dynamic approach allows teachers to adjust their teaching strategies to better meet the needs of their students. For instance, if a teacher notices through a quick quiz or class discussion that a significant portion of the class struggles with a particular concept, they can revisit that topic, providing additional explanations or alternative methods of instruction. This adaptability is crucial for fostering a deeper understanding of the material.

Formative assessments come in various forms, ranging from informal methods like classroom discussions, observations, and questioning, to more structured approaches such as quizzes, peer assessments, and self-reflections. These methods are not limited to paper-and-pencil tasks but can include digital tools that provide instant feedback. The versatility of formative assessments allows educators to cater to diverse learning styles and preferences, ensuring that all students are engaged and supported in their learning journey.

Formative assessment plays a significant role in creating a supportive classroom environment. It shifts the focus from merely achieving grades to understanding the learning process. This approach reduces the pressure on students, as they perceive assessments not as a final judgment of their abilities but as a part of their learning journey. Consequently, formative assessment can lead to increased student motivation and engagement.

In conclusion, formative assessment is a powerful tool that, when effectively implemented, can significantly enhance the learning experience. It provides invaluable insights for both teachers and students, promotes a growth-oriented learning environment, and supports the continuous development of essential skills. As education evolves, the role of formative assessment will undoubtedly continue to be central in fostering successful and meaningful learning experiences.

SUMMATIVE ASSESSMENT: EVALUATING LEARNING OUTCOMES IN THE FORM OF TERMINAL/FINAL EXAMINATION

Summative assessment is a fundamental component of the educational process, designed to evaluate student learning at the conclusion of an instructional period. Unlike formative assessment, which provides ongoing feedback during the learning process, summative assessment serves as a final measure of what students have learned. Typically administered at the end of a unit, course, or academic year. Summative assessment aims to determine the extent to which educational objectives have been achieved.

The primary purpose of summative assessment is to assess the overall effectiveness of instruction and learning. It provides a conclusive evaluation of student performance, often in the form of tests, final projects, or standardized exams. These assessments generate grades or scores that reflect a student's achievement in a given subject area over a specific period or time duration.

Summative assessment is often used to make critical decisions regarding student progression, certification, or placement in subsequent educational levels. Additionally, summative assessments provide valuable data that inform curriculum development and instructional strategies. By analyzing summative assessment results, educators can identify trends, strengths, and weaknesses within their instructional approaches, allowing for improvements in future teaching.

In conclusion, summative assessment plays a critical role in the educational process by providing a final evaluation of student learning. While it differs from formative assessment in its focus and application, it is an essential tool for measuring academic achievement. When balanced with formative assessments, summative assessments contribute to a well-rounded and effective approach to evaluating and supporting student learning.

National Curriculum of Pakistan 2022-2023

Assessment Framework Physics Grade-X (SSC-II)

Details of Content Areas/ SLOs

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
Domain: C Heat and Thermodynamics				
Heat Capacity				
[SLO: P-10-C-01] Define and calculate specific heat.	Summative for theory	Knowledge+ Understanding + Application	Question will be asked in final examination	03 periods
[SLO: P-10-C-02] Suggest experiments to measure the specific heat capacity of a solid and of a liquid.	Summative For PBA	Understanding+ Application	Question will be asked in PBA	
[SLO: P-10-C-03] Analyze everyday effects due to the large specific heat of water.	Summative for theory	Application	Question(s) will be asked in final examination.	
Thermal Expansion and Kinetic Theory of Matter:				7 periods
[SLO: P-10-C-04] Use the terms for the changes in state between solids, liquids and gasses [including deposition and sublimation].	Summative for theory	Knowledge+ Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-C-05] Explain thermal expansion in terms of kinetic theory for solids, liquids and gasses. [This includes stating the relative order of magnitudes of the expansion of solids, liquids and gasses].	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-C-06] Analyze the applications and consequences of thermal expansion in real life.	Summative for theory	Application	Question(s) will be asked in final examination.	
[SLO: P-10-C-07] Analyze melting, solidification, boiling and condensation in terms of energy transfer without a change in temperature.	Summative for theory	Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-C-08] State the melting and boiling temperatures for water at standard atmospheric pressure.	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-C-09] Describe qualitatively the thermal expansion of solids [linear and volumetric expansion].	Summative for theory	Knowledge+ Understanding+ Application	Question(s) will be asked in final examination.	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO: P-10-C-10] Explain the thermal expansion of liquids [real and apparent expansion].	Summative for theory	Knowledge+ Understanding+ Application	Question(s) will be asked in final examination.	
Gases, Pressure, and Thermal Expansion				
[SLO: P-10-C-11] Analyze the pressure and the changes in pressure of a gas in terms of particles. [The forces exerted by particles colliding with surfaces, creating a force per unit area].	Summative for theory	Understanding	Question will be asked in final examination	
Changes in State:				08 periods
[SLO: P-10-C-12] Differentiate between boiling and evaporation.	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-C-22] Describe evaporation in terms of particles [in terms of the escape of more energetic particles from the surface of a liquid].	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-C-23] Analyze how temperature, humidity, surface area and air movement over a surface affect evaporation.	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-C-24] Explain how evaporation causes cooling.	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-C-25] Describe the use of cooling caused by evaporation in the refrigeration process without using harmful CFCs.	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-C-26] Explain latent heat [as the energy required to change the state of a substance and explain it in terms of particle behavior and the forces between particles].	Summative for theory	Knowledge+ Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-C-27] Justify experiments to determine latent heat of fusion and latent heat of vaporization of ice and water [including illustrating the analysis of data by sketching temperature-time graph on heating ice].	Summative for PBA only	Understanding+ Application	Lab work-Question(s) will be asked in PBA	
[SLO: P-10-C-28] State that certain materials, when cooled to near absolute zero, can exhibit superconductivity.	Formative	Knowledge+ Understanding	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-C-29] Describe superconductivity [as when atoms are in this state, their kinetic energy is low, so there is little (or no) resistance to the flow of electrons].	Formative	Knowledge+ Understanding	Question(s) will not be asked in annual	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
			examination, however it will be a part of classroom teaching	
Modes of Heat Transfer:				
[SLO: P-10-C-30] Justify experiments to distinguish between good and bad thermal conductors.	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination.	09 periods
[SLO: P-10-C-31] Explain thermal conduction in all solids [in terms of atomic or molecular lattice vibrations and also in terms of the movement of free (delocalized) electrons in metallic conductors].	Summative for theory	Knowledge+ Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-C-32] Explain convection in liquids and gasses [in terms of density changes]. Justify experiments to illustrate convection.	Summative for theory	Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-C-33] Explain convection in seawater to support marine life.	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-C-34] Describe the role of land breezes and sea breezes in maintaining moderate coastal climates.	Summative for theory	Understanding +Application	Question(s) will be asked in final examination.	
[SLO: P-10-C-35] Explain how birds are able to fly for hours without flapping their wings and gliders are able to rise by riding on thermal currents.	Summative for theory	Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-C-36] Describe the process of thermal energy transfer by radiation. [And know that it does not require a medium].	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-C-37] Describe the effect of surface color and texture on the emission, absorption and reflection of infrared radiation.	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-C-38] Justify qualitatively how the rate of emission of radiation depends on the surface temperature and surface area of an object.	Summative for theory	Knowledge+ Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-C-39] Justify Experiments to distinguish between good and bad emitters and absorbers of infrared radiation.	Summative for theory	Understanding +Application	Question(s) will be asked in final examination.	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO: P-10-C-40] Analyze the consequence of heat radiation in the greenhouse effect and its effect in global warming.	Summative for theory	Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-C-41] Analyze everyday applications of conduction, convection and radiation [Including: (a) heating objects such as kitchen pans (b) heating a room by convection (c) measuring temperature using an infrared thermometer (d) using thermal insulation to maintain the temperature of a liquid and to reduce thermal energy transfers in buildings (e) the mechanism of a household hot-water system]	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-F-23] Use ideas of convection to explain how cyclones are formed.	Summative for theory	Understanding + Application	Question(s) will be asked in final examination	
[SLO: P-10-F-24] Explain how global warming contributes to extreme weather events. [Specifically in the case of hurricanes, heat waves, flooding, rainfall, wildfires, droughts and winter storms].	Summative for theory	Understanding + Application	Question(s) will be asked in final examination	
[SLO: P-10-F-25] Explain the phenomena of geothermal activity on the basis of conduction, convection and radiation. [How magma flows beneath the Earth, why it causes tectonic plate movement, volcanic eruptions and how the center of the Earth remains hot since being formed over 4 billion years ago].	Formative	Understanding+ Application	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
Domain D: Waves				8 periods
Wave Theory:				
[SLO: P-10-D-01] Prove that waves transfer energy without transferring matter.	Summative for theory	Knowledge+ Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-02] Describe what is meant by wave motion. [As illustrated by vibrations in ropes and springs and by experiments using water waves].	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-03] Describe the features of a wave. [in terms of wave front, wavelength, frequency, time period, crest (peak), trough, compression, rarefaction, amplitude and wave speed].	Summative for theory	Knowledge+ Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-04] Define the terms frequency, wavelength, and amplitude.	Summative for theory	Knowledge	Question(s) will be asked in final	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
			examination.	
[SLO: P-10-D-05] Recall and apply the equation wave speed = frequency x wavelength (v =fλ).	Summative for theory	Knowledge+ Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-D-06] Illustrate that for a transverse wave, the direction of vibration is at right angles to the direction of the energy transfer. [Including giving examples such as electromagnetic radiation, waves on the surface of water, and seismic S-waves (secondary).	Summative for theory	Knowledge+ Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-07] Illustrate that for a longitudinal wave, the direction of vibration is parallel to the direction of the energy transfer [including giving examples such as sound waves and seismic P-waves (primary)].	Summative for theory	Knowledge+ Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-08] Describe how waves can undergo reflection, refraction and diffraction.	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-09] Describe how wavelength affects diffraction at an edge.	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-10] Analyze the phenomenon of tsunamis generated under the surface of water [in terms of underwater earthquakes/volcanic activity generating waves that increase in frequency and amplitude as they encounter increasingly shallow water].	Summative for theory	Application	Question(s) will be asked in final examination.	
[SLO: P-10-D-11] Describe how wavelength and gap size affect diffraction through a gap.	Summative for theory	Understanding	Question(s) will be asked in final examination.	
Sound:				8 periods
[SLO: P-10-D-12] Describe the production of sound.	Summative for theory	Knowledge+ Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-13] Describe the longitudinal nature of sound waves.	Summative for theory	Knowledge+ Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-14] State the approximate range of frequencies audible to humans as 20Hz to 20000Hz.	Summative for theory	Knowledge	Question(s) will be asked in final examination.	
[SLO: P-10-D-15] Justify why sound waves cannot travel in a vacuum. [Including describing experiments to demonstrate this].	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination.	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO: P-10-D-16] Describe how changes in amplitude and frequency affect the loudness and pitch of sound waves.	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-17] Describe how different sound sources produce sound waves with different timbres [including making reference to the shape of the traces on an oscilloscope].	Summative for theory	Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-D-18] Describe an echo as the reflection of sound waves.	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-19] Justify simple experiments to show the reflection of sound waves.	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-20] Illustrate a method involving a measurement of distance and time for determining the speed of sound in air.	Summative for theory	Application	Question(s) will be asked in final examination.	
[SLO: P-10-D-21] State that the speed of sound in air is approximately 330-350m/s.	Summative for theory	Knowledge	Question(s) will be asked in final examination.	
[SLO: P-10-D-22] Describe that, in general, sound travels faster in solids than in liquids and faster in liquids than in gasses.	Summative for theory	Knowledge + Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-23] Define ultrasound as sound with a frequency higher than 20kHz.	Summative for theory	Knowledge	Question(s) will be asked in final examination.	
[SLO: P-10-D-24] Illustrate and analyze the uses of ultrasound. [In cleaning, prenatal and other medical scanning, and in sonar (including calculation of depth or distance from time and wave speed)].	Summative for theory	Knowledge+ Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-D-25] Illustrate the use of infrasound [e.g., by elephants in communication, and in the study of seismic activity].	Summative for theory	Knowledge + Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-26] Analyze the effects of noise pollution on the environment.	Summative for theory	Application	Question(s) will be asked in final examination.	
[SLO: P-10-D-27] Justify the importance of acoustic protection.	Summative for theory	Knowledge + Understanding	Question(s) will be asked in final examination.	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO: P-10-D-28] Describe how knowledge of the properties of sound waves is applied in the design of buildings with respect to acoustics.	Summative for theory	Knowledge + Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-D-29] Explain the use of soft materials to reduce echo sounding [such as in classroom studies, and other public gathering buildings].	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-30] Explain, with examples, how sound can reflect, refract and diffract.	Summative for theory	Knowledge+ Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-31] Explain how sound is converted by the eardrum and nerves into electrical signals that are then interpreted by the brain.	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
Geometrical optics				15 periods
[SLO: P-10-D-32] Define and use the terms normal, angle of incidence and angle of Reflection.	Summative for theory	Knowledge	Question(s) will be asked in final examination.	
[SLO: P-10-D-33] Describe an experiment to find the position and characteristics of an optical image formed by a plane mirror. [Same size, same distance from mirror as object and virtual image].	Summative for theory	Understanding	Question(s) will be asked in final examination	
[SLO: P-10-D-34] Use the laws of reflection to solve simple optical problems.	Summative for theory	Understanding +application	Question(s) will be asked in final examination.	
[SLO: P-10-D-35] Define the terms normal, angle of incidence and angle of refraction.	Summative for theory	Knowledge	Question(s) will be asked in final examination.	
[SLO: P-10-D-36] Apply the qualitative principle that a wave refracts towards the normal when it slows down while entering a medium, and that it refracts away from the normal if it speeds up when it enters a new medium. [In the case the angle of incidence is zero, then the waves continue parallel to the normal].	Summative for theory	Knowledge+ Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-D-37] Define and use the refractive index from a vacuum to a medium for light as c/v.	Summative for theory	Knowledge + Understanding + Application	Question(s) will be asked in final examination.	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO: P-10-D-38] Define refractive index n as n= sin(i)/sin(r). Apply Snell's law, n_i sin (i) = n_r sin (r) to solve simple problems	Summative for theory	Knowledge + Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-D-39] Describe an experiment to show refraction of light by transparent blocks of different shapes.	Summative for PBA	Understanding +Application	Lab work-Question(s) will be asked in PBA	
[SLO: P-10-D-40] Define the terms critical angle and total internal reflection.	Summative for Theory and PBA	Knowledge + Understanding	Question(s) will be asked in theory examination and PBA.	
[SLO: P-10-D-41] Derive the equation n = 1/sin (c).	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-42] Apply the equation n = 1/sin (c) to solve simple problems.	Summative for theory	Application	Question(s) will be asked in final examination.	
[SLO: P-10-D-43] Describe experiments to show internal reflection and total internal reflection.	Summative for theory	Understanding +Application	Question(s) will be asked in final examination.	
[SLO: P-10-D-44] Evaluate and illustrate the use of optical fibers [particularly in telecommunications, stating the advantages of their use in each context].	Summative for theory	Application	Question(s) will be asked in final examination.	
[SLO: P-10-D-45] Analyze the action of thin converging and thin diverging lenses on a parallel beam of light.	Summative for theory	Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-D-46] Define and use the terms focal length, principal axis and principal focus (focal point)	Summative for theory	Knowledge + Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-47] Draw ray diagrams to illustrate the formation of real and virtual images of an object by a converging lens.	Summative for theory	Understanding +Application	Question(s) will be asked in final examination.	
[SLO: P-10-D-48] Differentiate between real and virtual images.	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-49] Define and calculate linear magnification [as the ratio of image length to object length; state and use the equation linear magnification = image length/object length].	Summative for theory	Knowledge + Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-D-50] Describe the use of a single lens a magnifying glass.	Summative for theory	Application	Question(s) will be asked in final examination.	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO: P-10-D-51] Explain the dispersion of light by a prism. [Including the detection of nonvisible spectra by a thermometer].	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-D-52] State the traditional seven colors of the visible spectrum in order of frequency and in order of wavelength.	Summative for theory	Knowledge	Question(s) will be asked in final examination.	
[SLO: P-10-D-53] Describe the use of a single lens as in various optical device applications [specifically in the case of a magnifying glass, a camera, projector, and a photographic enlarger. This includes drawing ray diagrams to show how each form an image].	Formative	Application	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching.	
[SLO: P-10-D-54] Draw ray diagrams to show the formation of images in the normal eye, a short-sighted eye and a long-sighted eye.	Summative for theory	Knowledge + Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-D-55] Describe the use of converging and diverging lenses to correct long-sightedness and short-sightedness.	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination	
[SLO: P-10-D-56] Illustrate with examples how the biological eye processes color in various organisms. [a. role of rods and cones in the eye, along with the brain, in detecting light and discerning color in combinations of 3 channels (red, yellow, blue). b. know that different living organisms may see more and less colors e.g. the mantis shrimp has 12 channels of color and view ultraviolet light].	Formative	Understanding	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching.	
[SLO: P-10-D-57] State that extreme gravity from interstellar objects like black holes can cause light to bend (from the perspective of the observer) in a way that is analogous to a simple lens. [This is called 'gravitational lensing'].	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-D-58] State that 'acoustic lenses' are made of materials and shapes that work to focus or diverge sound.	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
Domain E: Electricity and Magnetism				10 periods
[SLO: P-10-E-01] State that there are positive and negative charges. [And charge is measured in coulombs].	Summative for theory	Knowledge	Question(s) will be asked in final examination.	
[SLO: P-10-E-02] State that unlike charges attract and like charges repel.	Summative for theory	Knowledge	Question(s) will be asked in final examination.	
[SLO: P-10-E-03] Describe experiments to show electrostatic charging by friction.	Summative for theory	Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-04] Explain that charging of solids by friction involves only a transfer of negative charge (electrons).	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-09-E-05] Explain how and why an insulator can be discharged by (a) putting it above a flame, and (b) exposing it to damp conditions.	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-E-06] Explain how a conductor can be charged by electric induction and then "earthing".	Summative for theory	Understanding	Question(s) will be asked in final examination	
[SLO: P-10-E-07] Describe examples where charging could be a problem e.g., lightning.	Summative for theory	Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-08] Suggest how charging and discharging is used in the application of various devices [e.g. photocopier and electrostatic precipitator].	Summative for theory	Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-09] Describe an electric field as a region in which an electric charge experiences a force.	Summative for theory	Knowledge + Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-E-10] State that the direction of an electric field line at a point is the direction of the force on a positive charge at that point.	Summative for theory	Knowledge	Question(s) will be asked in final examination.	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO: P-10-E-11] Analyze and illustrate simple electric field patterns. [including the direction of the field: (a) around a point charge (b) around a charged conducting sphere (c) between two oppositely charged parallel conducting plates (end effects will not be examined)]	Summative for theory	Knowledge+ understanding	Question(s) will be asked in final examination.	
[SLO: P-10-E-12] State examples of electrical conductors and insulators.	Summative for theory	Knowledge	Question(s) will be asked in final examination.	
[SLO: P-10-E-13] Describe an experiment to distinguish between electrical conductors and insulators.	Summative for theory	Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-14] State and use a simple electron model to explain the difference between electrical conductors and insulators.	Summative for theory	Knowledge+ Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-E-15] Explain how a lightning rod can protect humans.	Summative for theory	Knowledge	Question(s) will be asked in final examination.	
[SLO: P-10-E-16] Explain electrical breakdown [it occurs when a strong electric field passes through a gas and causes its atoms to ionize].	Summative for theory	Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-17] State that Corona discharge and Lichtenberg figures are visible examples of electrical breakdown.	Summative for theory	Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-18] Explain how lightning is generated [Including the below steps of formation: - through friction between the water molecules suspended in clouds in the case of thunderstorms, and from between smoke particles in the case of volcanic lightning - lightning streamers are created through the process of electrical breakdown and this provides a path for the electric current from one charged object to the other - in the case of cloud-ground lightning a strong electric field from the clouds induces an opposite net charge in the conducting material present in the ground, and when this field becomes strong enough it generates lightning streams that provide the path for cloud-to ground and ground-to-cloud discharge].	Summative for theory	Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-19] State that there are many kinds of atmospheric lightning [e.g., sprites, jets, elves, trolls, pixies, ghosts, ball lightning) that are still being	Formative	Knowledge	Question(s) will not be asked in annual	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
researched].			examination, however it will be a part of classroom teaching.	
Electric current and Ohm's Law				10 periods
[SLO: P-10-E-20] Define and calculate electric current. [Use the equation electric current = charge/time | = Q/t to solve simple problems].	Summative for theory	Knowledge + Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-21] Explain electrical conduction [in metals in terms of the movement of free electrons].	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-E-22] State that current is measured in amps (amperes) and that the amp is given by coulomb per second (C/s).	Summative for theory	Knowledge + Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-E-23] Differentiate between direct current (d.c) and alternating current (a.c).	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-E-24] Differentiate between conventional and actual current.	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-E-25] Justify and illustrate the use of ammeters [(analogue and digital) with different ranges].	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-E-26] Define e.m.f. [as the electrical work done by a source in moving a unit charge around a complete circuit. Use the equation e.m.f. = work done (by a source) per unit charge E = W/Q].	Summative for theory	Knowledge + Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-27] Define p.d. (potential difference). [As the work done by a unit charge passes through a component. Use the equation p.d. = work done (on a component) charge V = W/Q to solve simple problems].	Summative for theory	Knowledge + Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-28] State that e.m.f. and p.d. are measured in volts and that the volt is given by joule per coulomb (J/C).	Summative for theory	Knowledge	Question(s) will be asked in final examination.	
[SLO: P-10-E-29] Justify and illustrate the use of voltmeters. [(analogue and digital) with different ranges].	Formative	Knowledge	Question(s) will not be asked in annual	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
			examination, however it will be a part of classroom teaching.	
[SLO: P-10-E-30] Calculate the total e.m.f. where several sources are arranged in series.	Summative for theory	Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-31] State that the e.m.f of identical sources connected in parallel is equal to the e.m.f. of one of the sources.	Summative for theory	Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-32] Describe an experiment to determine resistance. [Using a voltmeter and an ammeter and do the appropriate calculations].	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching.	
[SLO: P-10-E-33] Define and calculate resistivity [Use for a wire, the direct proportionality between resistance and length, and the inverse proportionality between resistance and cross-sectional area].	Summative for theory	Knowledge + Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-34] Define and apply Ohm''s law. [Including reference to constant temperature. Use the equation resistance = p.d./current R = V/I to solve simple problems].	Summative for theory and PBA	Knowledge + Understanding + Application	Question(s) will be asked in theory examination and PBA.	
[SLO: P-10-E-35] Describe the effect of temperature increase on the resistance of a resistor [such as the filament in a filament lamp].	Summative for Theory	Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-36] Interpret current-voltage graphs. [Including for a resistor of constant resistance, a filament lamp and a diode].	Summative for Theory and PBA	Understanding+ Application	Question(s) will be asked in theory examination and PBA.	
Circuit Diagrams:				10 periods
[SLO: P-10-E-37] Draw circuit diagrams. [with cells, batteries, power supplies, generators, potential dividers, switches, resistors (fixed and variable), heaters, thermistors (NTC only), light-dependent resistors (LDRs), lamps, motors, ammeters, voltmeters, transformers, fuses, relays, diodes and light-emitting diodes (LEDs)].	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination.	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO: P-10-E-38] Use common rules regarding current and voltage distribution in circuits to solve problems. [specifically: (a) the current at every point in a series circuit is the same (b) the sum of the currents entering a junction in a parallel circuit is equal to the sum of the currents that leave the junction (c) the total p.d. across the components in a series circuit is equal to the sum of the individual p.d.s across each component (d) the p.d. across an arrangement of parallel resistances is the same as the p.d. across one branch in the arrangement of the parallel resistances]	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-39] Calculate the combined resistance of two or more resistors in series.	Summative for theory	Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-40] Calculate the combined resistance of two resistors in parallel.	Summative for theory	Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-41] Calculate current, voltage and resistance in parts of a circuit or in the whole circuit.	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-42] Describe the action of negative temperature coefficient (NTC) thermistors and light-dependent resistors. [Including explaining their use as input sensors].	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-43] Analyze the function of variable potential dividers in circuits. [Including using the equation for two resistors used as a potential divider $R_1/R_2= V_1/V_2$].	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-44] Justify and illustrate the use of color codes for resistors.	Summative for theory	Knowledge + Understanding	Question(s) will be asked in final examination.	
Electric Appliances and Transmission:				08 periods
[SLO: P-10-E-48] State common uses of electricity. [Including heating, lighting, battery charging and powering motors and electronic systems].	Summative for theory	Knowledge	Question(s) will be asked in final examination.	
[SLO: P-10-E-49] Justify the advantages of connecting lamps in parallel in a lighting circuit.	Summative for theory	Knowledge	Question(s) will be asked in final examination.	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO: P-10-E-50] Use the equation, power = current x voltage P = IV to solve simple Problems.	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-51] Use the equation energy = current x voltage x time E = IVt to solve simple problems.	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-52] Define the kilowatt-hour (kWh).	Summative for theory	Knowledge	Question(s) will be asked in final examination.	
[SLO: P-10-E-53] Explain the need to choose components with suitable power ratings.	Summative for theory	Understanding + Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-54] Calculate the cost of using electrical appliances where the energy unit is the kWh.	Summative for theory	Application	Question(s) will be asked in final Examination	
[SLO: P-10-E-55] State common electric hazards that may be caused from malpractice and lack of maintenance. [specifically: a) damaged insulation (b) overheating cables (c) damp conditions (d) excess current from overloading of plugs, extension leads, single and multiple sockets when using a mains supply]	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-E-56] Explain the use and operation of trip switches and fuses and choose appropriate fuse ratings and trip switch settings.	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-E-57] Explain what happens when a live wire touches a metal case that is Earthed.	Summative for theory	Knowledge	Question(s) will be asked in final examination.	
[SLO: P-10-E-58] Explain why the outer casing of an electrical appliance must be either non-conducting (double-insulated) or earthed.	Summative for theory	Knowledge	Question(s) will be asked in final examination.	
[SLO: P-10-E-59] State that a main circuit consists of a live wire (line wire), a neutral wire and an earth wire.	Summative for theory	Knowledge	Question(s) will be asked in final examination.	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO: P-10-E-60] Explain why fuses and circuit breakers are connected into the live wire for the circuit to be switched off safely.	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-E-61] Explain why domestic supplies are connected in parallel.	Summative for theory	Knowledge	Question(s) will be asked in final examination.	
[SLO: P-10-E-62] Explain the damage that electric shock could do to a human being. [In terms of burns, cardiorespiratory failure and seizures].	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching.	
Electronics:				20 periods
[SLO: P-10-E-45] Describe the working of a diode.	Summative for theory	Knowledge + Understanding	Question(s) will be asked in final examination	
[SLO: P-10-E-46] Describe the action of a light emitting diode in passing current in one direction only and emitting light.	Summative for theory	Knowledge + Understanding	Question(s) will be asked in final examination	
[SLO: P-10-E-47] Describe and explain the action of relays in switching circuits.	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching.	
[SLO: P-10-E-63] Explain that electronic devices are built from digital logic circuits. [That can act as switches that can convert incoming voltage into binary electrical pulses of high and low (or 1 and 0)].	Summative for theory	Knowledge+ Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-E-64] Explain that Boolean logic is the basis for converting analogue data to digital data [this includes knowing that ‘bit' is the smallest unit of data in computing; either 1 or 0. Eight bits make up a byte].	Summative for theory	Knowledge+ Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-E-65] State in words and in truth table form, the action of logic gates. [Specifically of AND, OR, NAND, NOR and NOT.	Summative for theory	Knowledge	Question(s) will be asked in final examination.	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO: P-10-E-66] Identify the use of logic gates for security purposes. [e.g.; burglar alarm, fire extinguish etc].	Summative for theory	Application	Question(s) will be asked in final examination.	
[SLO: P-10-E-67] Use circuit symbols for the logic gates.	Summative for theory	Knowledge	Question(s) will be asked in final examination.	
[SLO: P-10-E-68] Identify in given problems how Boolean switches can be put into combinations that then allow them to achieve logical operations.	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-E-69] Describe the action of a bipolar npn transistor as a switch.	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-E-70] Explain that transistors are commonly used in digital devices because they are both economical and act as rapid-response switches. [To enrich this concept students should be given an overview of how with advances in engineering, the number of transistors that can be fit per unit area onto a circuit board has continued to increase dramatically; this has rapidly enhanced computing power. They also be given an overview of how - breakthroughs in quantum physics are causing a new revolution in computing that are enabling computers to make exponentially more logical operations per unit time than with traditional computers].	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-E-71] State that circuits that maintain their 'state' after receiving an input can be said to exhibit 'memory' [Since they retain the effect of the last action upon them (this should be taught to them with the context provided that circuit systems that allow for logical processing and memory functions form the basis of programmable electronics)].	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO: P-10-E-72] State that quantum computers are still in early stages of development, and have to overcome manufacturing challenges such core components only functioning at very cold temperatures that are at almost absolute zero.	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-E-73] Compare analogue and digital electronics.	Summative for theory	Understanding	Question(s) will be asked in final examination.	
Electromagnetisms				
[SLO: P-10-E-74] Describe an experiment to demonstrate electromagnetic induction.	Summative for theory	Understanding	Question(s) will be asked in final examination.	
[SLO: P-10-E-75] Use the fact that the magnitude of an induced e.m.f. is affected by (a) the rate of change of the magnetic field or the rate of cutting of magnetic field lines, and (b) the number of turns in a coil, to solve simple electromagnetic problems.	Summative for theory	Understanding + Application	Question(s) will be asked in final examination	
[SLO: P-10-E-76] Use the fact that the effect of the current produced by an induced e.m.f. is to oppose the change producing it (Lenz's law).	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination	
[SLO: P-10-E-77] Describe how a.c. generators work [(Rotating coil or rotating magnet setup) and the use of slip rings and brushes where needed].	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination	
[SLO: P-10-E-78] Sketch and interpret graphs of e.m.f. against time for simple a.c. generators [Including relating the position of the generator coil to the peaks, troughs and zeros of the e.m.f].	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination	
[SLO: P-10-E-79] Describe the pattern and direction of the magnetic field due to currents in straight wires and in solenoids.	Summative for theory	Knowledge	Question(s) will be asked in final examination	
[SLO: P-10-E-80] State the effect on the magnetic field of changing the magnitude and direction of the current.	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination	
[SLO: P-10-E-81] Describe how the magnetic effect of a current is used in relays and loudspeakers [Including giving examples of their application].	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
			teaching	
[SLO: P-10-E-82] Describe an experiment to show that a force acts on current carrying conductor in a magnetic field. [including the effect of reversing: (a) the current (b) the direction of the field]	Summative for theory	Understanding	Question(s) will be asked in final examination	
[SLO: P-10-E-83] State and use the relative directions of force, magnetic field and current.	Summative for theory	Understanding + Application	Question(s) will be asked in final examination	
[SLO: P-10-E-84] Describe the magnetic field patterns between currents in parallel conductors and relate these to the forces on the conductors. [Excluding the Earth's field].	Summative for theory	Application	Question(s) will be asked in final examination	
[SLO: P-10-E-85] State that a current-carrying coil in a magnetic field may experience a turning effect and that the turning effect is increased by increasing: (a) the number of turns on the coil (b) the current (c) the strength of the magnetic field	Summative for theory	Application	Question(s) will be asked in final examination	
[SLO: P-10-E-86] Describe the operation of an electric motor, including the action of a split-ring commutator and brushes.	Summative for theory	Understanding + Application	Question(s) will be asked in final examination	
[SLO: P-10-E-87] State that it is theorized that the Earth's magnetic field is generated by the rotation of the Earth and it molten iron core that contains charged particles in motion.	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-E-88] Explain the principle of operation of a simple iron-cored transformer.	Summative for theory	Understanding	Question(s) will be asked in final examination	
[SLO: P-10-E-89] Use the terms primary, secondary coils and step-up and step-down transformer.	Summative for theory	Understanding	Question(s) will be asked in final examination	
[SLO: P-10-E-90] Use the equation $V_p / V_s = N_p / N_s$ [Where P and S refer to primary and secondary, to solve problems].	Summative for theory	Application	Question(s) will be asked in final examination	
[SLO: P-10-E-91] Justify the advantages of high voltage transmission. [Including	Summative for theory	Application	Question(s) will be asked in final	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
explaining why power losses in cables are smaller when the voltage is greater].			examination	
[SLO: P-10-E-92] Describe the deflection of an electron beam by electric fields and magnetic fields.	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-E-93] Interpret waveforms on oscilloscope.	Formative	knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
Electromagnetic Waves:				5 periods
[SLO: P-10-E-94] State the main regions of the electromagnetic spectrum in order of frequency and in order of wavelength.	Summative for theory	knowledge	Question(s) will be asked in final examination	
[SLO: P-10-E-95] State that the speed of all electromagnetic waves in: (a) a vacuum is 3.0 x 10^8 m/s (b) air is approximately the same as in a vacuum	Summative for theory	Knowledge	Question(s) will be asked in final examination	
[SLO: P-10-E-96] Describe the applications of electromagnetic waves in society. [specifically: (a) radio waves — radio and television communications, astronomy (b) microwaves — satellite television, mobile (cell) phone, Bluetooth, microwave ovens (c) infrared — household electrical appliances, remote controllers, intruder alarms, thermal imaging, optical fibers (d) visible light — photography, vision (e) ultraviolet — security marking, detecting counterfeit bank notes, sterilizing water (f) X-rays — hospital use in medical imaging, security scanners, killing cracks in metal (g) gamma rays — medical treatment in detecting and killing cancerous cells, sterilizing food and medical equipment, engineering applications such as detecting cracks in metal]	Formative	knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO: P-10-E-97] Describe the damage caused by electromagnetic radiation. [Including (a) excessive exposure causing heating of soft tissues and burns and (b) ionizing effects caused by ultraviolet (skin cancer and cataracts), X-rays and gamma rays (cell mutation and cancer)].	Formative	knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-E-98] Explain qualitatively, how scattering of light by molecules in the air give the sky its blue color during the day and its shades of red during sunset. [Use of the terms Rayleigh and Mei scattering are not required].	Summative for theory	Understanding	Question(s) will be asked in final examination	
[SLO: P-10-E-99] State that theoretically light can also be considered to be made of massless particles that carry energy and momentum called 'photons'. [Students should know as an example of this particle nature; light exerts pressure on objects (very slight) and this has been used by satellites that have 'solar sails' that accelerate with the help of force from light rays].	Summative for theory	Knowledge	Question(s) will be asked in final examination	
Domain F: Modern Physics				15 periods
[SLO: P-10-F-01] Describe the structure of the atom. [In terms of a positively charged nucleus and negatively charged electrons that go around the nucleus. This should include an understanding of the below big ideas: - These electrons do not go around in predictable circular paths in the way that planets go around the sun. The electrons behave as 'quantum particles' and their location and momentum at any point in time is governed by probability; one cannot predict the motion of an electron. - The 'shells' in which electrons 'orbit' refer to the level of kinetic energy the electrons possess; the farther the shell is from the nucleus, the more energy the electron has. - If one were to 'look' at an atom, one would see a fuzzy 'cloud' of electrons with a very small nucleus in the center (akin to a football with flies around it in a boundary of several football fields)].	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-F-02] Justify the findings of the alpha particle scattering experiments. [Specifically, that it provides evidence for: (a) a very small nucleus surrounded by mostly empty space (b) a nucleus containing most of the mass of the atom (c) a nucleus that is positively charged]	Summative for theory	Understanding	Question(s) will be asked in final examination	
[SLO: P-10-F-03] Define the terms proton number (atomic number) Z and nucleon number (mass number) A and be able to calculate the number of neutrons in a nucleus.	Summative for theory	Knowledge	Question(s) will be asked in final examination	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO: P-10-F-04] Recall the term nuclide and use the nuclide notation ${}_{z}X^{A}$.	Summative for theory	Knowledge	Question(s) will be asked in final examination	
[SLO: P-10-F-05] Explain what is meant by an isotope and state that an element may have more than one isotope.	Summative for theory	Knowledge	Question(s) will be asked in final examination	
[SLO: P-10-F-06] Explain what is meant by background radiation.	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-F-07] State the sources that make a significant contribution to background radiation. [Including: (a) radon gas (in the air) (b) rocks and buildings (c) food and drink (d) cosmic rays].	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-F-08] Describe the emission of radiation from a nucleus as spontaneous and random.	Summative for theory	Knowledge+ Understanding	Question(s) will be asked in final examination	
[SLO: P-10-F-09] Describe α-particles, β-particles and γ-radiation.	Summative for theory	Knowledge	Question(s) will be asked in final examination	
[SLO: P-10-F-10] Justify qualitatively the order of strength for α-particles, β-particles and γ-radiation in terms of their (a) their relative ionizing effects (b) their relative penetrating powers	Summative for theory	Knowledge + Understanding	Question(s) will be asked in final examination	
[SLO: P-10-F-11] Describe the deflection of α-particles, β-particles and γ-radiation in electric fields and magnetic fields.	Summative for theory	Knowledge + Understanding	Question(s) will be asked in final examination	
[SLO: P-10-F-12] Explain that radioactive decay is a change in an unstable nucleus that can result, most commonly [there are other kinds of decay as well but students are not required to study those at this level), in the emission of α-particles, β-particles and γ-radiation].	Summative for theory	Knowledge + Understanding	Question(s) will be asked in final examination	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO: P-10-F-13] Use decay equations, using nuclide notation, to show the emission of α-particles, β-particles and y-radiation.	Summative for theory	Understanding + Application	Question(s) will be asked in final examination	
[SLO: P-10-F-14] Describe nuclear reactions (fission & fusion) with examples [fusion as the formation of a larger nucleus by combining two smaller nuclei with the release of energy, and recognize fusion as the energy source for stars].	Summative for theory	Knowledge + Understanding	Question(s) will be asked in final examination	
[SLO: P-10-F-14] Recognize that matter can be converted to energy and vice versa (in this way the law of conservation of energy still holds).	Summative for theory	Knowledge + Understanding	Question(s) will be asked in final examination	
[SLO: P-10-F-15] Apply the equation $E = mc^2$ to calculate the energy released in the process of nuclear reactions.	Summative for theory	Application	Question(s) will be asked in final examination	
[SLO: P-10-F-16] Describe the activity of a radioactive material in terms of counts per unit time.	Summative for theory	Knowledge + Understanding	Question(s) will be asked in final examination	
[SLO: P-10-F-17] Define and infer the half-life of materials [Half-life as the time taken for half the nuclei of an isotope in any sample to decay. Use this definition of half-life in calculations, which may involve information tables or decay curves].	Summative for theory	Knowledge + Understanding + Application	Question(s) will be asked in final examination	
[SLO: P-10-F-18] Explain and apply the concept of Carbon dating to solve problems.	Summative for theory	Understanding+ Application	Question(s) will be asked in final examination	
[SLO: P-10-F-19] Explain how the type of radiation emitted and the half-life of the isotope determine which isotope is used for applications: [including: (a) household fire (smoke) alarms (b) irradiating food to kill bacteria (c) sterilization of equipment using gamma rays (d) measuring and controlling thicknesses of materials with the choice of radiations used linked to penetration and absorption (e) diagnosis and treatment of cancer using gamma rays] used for applications	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-F-20] State the effects of ionizing nuclear radiations on living things, including cell death, mutations and cancer.	Formative	Knowledge	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-F-21] Explain how radioactive materials are moved, used and stored in a safe way. [(with reference to:	Formative	Knowledge	Question(s) will not be asked in annual	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
(a) reducing exposure time (b) increasing distance between source and living tissue (c) use of shielding to absorb radiation]			examination, however it will be a part of classroom teaching	
[SLO: P-10-F-22] Explain the nature of the Sun [as a star of medium size it consists mostly of hydrogen and helium, and that it radiates most of its energy in the infrared, visible and ultraviolet regions of the electromagnetic spectrum].	Formative	Knowledge + Understanding	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
[SLO: P-10-F-23] Describe that it is hypothesized that most of the matter in the universe is made up of dark matter.	Formative	Knowledge + Understanding	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
Domain G: Nature of Science				2 periods
Theory of Knowledge in Physics:				
[SLO: P-10-G-01] Explain, with examples in Physics, falsifiability as the idea that a theory is scientific only if it makes assertions that can be disproven.	Formative	Knowledge + Understanding	Question(s) will not be asked in annual examination, however it will be a part of classroom teaching	
Domain H: Experimentation Skills (PBA Skills)				55 periods
Benchmark |: Students should be able to follow provided safety instructions and take general precautions in a lab setting				
[SLO: P-09-10-N-01] Explain, with examples, how hazards in a science lab can be classified into: [(i) physical hazards, (ii) chemical hazards, (iii) biological hazards, (iv) safety hazards].	Formative for PBA	Knowledge	Question will not be asked in final examination of PBA. However, it will be part of Lab work.	
[SLO: P-09-10-N-02] Identify for a given experimental procedure what would be the most appropriate personal protective equipment to wear before setting the apparatus.	Formative for PBA	Understanding	Question will not be asked in final examination of PBA. However, it will be part of Lab work.	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO:P-09-10-N-03] Identify the meaning of common hazard signs in the laboratory.	Formative for PBA	Knowledge	Question will not be asked in final examination of PBA. However, it will be part of Lab work.	
[SLO: P-09-10-N-04] Call emergency services in case of an accident in the lab.	Formative for PBA	Understanding	Question will not be asked in final examination of PBA. However, it will be part of Lab work.	
Benchmark I: Create an outline of how to conduct an experiment to compare a given dependent variable and independent variable [SLO: P-09-10-N-05] Define and use the below terms: - True value: the value that would be obtained in an ideal measurement. - Measurement error: the difference between a measured value and the true value of a quantity. - Accuracy: a measurement result is described as accurate if it is close to the true value. - Precision: how close the measured values of a quantity are to each other. - Repeatability: a measurement is repeatable if the same or similar result is obtained when the measurement is repeated under the same conditions, using the same method, within the same experiment. - Reproducibility: a measurement is reproducible if the same or similar result is obtained when the measurement is made under either different conditions or by a different method or in a different experiment. - Validity of experimental design: an experiment is valid if the experiment tests what it says it will test. The experiment must be a fair test where only the independent variable and dependent variable may change, and controlled variables are kept constant. - Range: the maximum and minimum value of the independent or dependent variables. - Anomaly: an anomaly is a value in a set of results that appears to be outside the general pattern of the results, i.e. an extreme value that is either very high or very low in independent variables: independent variables are the variables that are changed in a scientific experiment by the scientist. Changing an independent variable may cause a change in the	Formative for PBA	Application	Question will not be asked in final examination of PBA. However, it will be part of Lab work.	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
dependent variable. - Dependent variables: dependent variables are the variables that are observed or measured in a scientific experiment. Dependent variables may change based on changes made to the independent variables.				
[SLO: P-09-10-N-06] Identify appropriate apparatus for collecting the data.	Formative for PBA	Understanding	Question will not be asked in final examination of PBA. However, it will be part of Lab work.	
[SLO: P-09-10-N-07] Visualize how the collected data would be tabulated or graphed.	Formative for PBA	Understanding	Question will not be asked in final examination of PBA. However, it will be part of Lab work.	
[SLO: P-09-10-N-08] Explain step by step the methodology for analyzing the data (e.g. gradient of line of best fit, plugging average value of dependent variable into a formula etc).	Formative for PBA	Understanding	Question will not be asked in final examination of PBA. However, it will be part of Lab work.	
[SLO: P-09-10-N-09] Suggest how sources of human and systematic error could be mitigated.	Formative for PBA	Application	Question will not be asked in final examination of PBA. However, it will be part of Lab work.	
Benchmark |: Collect data under instructor supervision while minimizing sources of random and systematic error				
[SLO: P-09-10-N-10] Set up experimental apparatus under supervision from an instructor.	Formative for PBA	Application	Question will not be asked in final examination of PBA. However, it will be part of Lab work.	
[SLO: P-09-10-N-11] Take steps to avoid parallax error.	Formative for PBA	Knowledge	Question will not be asked in final examination of PBA. However, it will be part of Lab work.	
[SLO: P-09-10-N-12] Identify and correct for potential zero error.	Formative for PBA	Application	Question will not be asked in final examination of PBA.	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
			However, it will be part of Lab work.	
[SLO: P-09-10-N-13] Take an appropriate number of readings to average out errors.	Formative for PBA	Application	Question will not be asked in final examination of PBA. However, it will be part of Lab work.	
[SLO: P-09-10-N-14] Take correct meniscus readings.	Formative for PBA	Application	Question will not be asked in final examination of PBA. However, it will be part of Lab work.	
[SLO: P-09-10-N-15] Record sources of potential error (e.g. lack of lighting due to power outage).	Formative for PBA	Understanding	Question will not be asked in final examination of PBA. However, it will be part of Lab work.	
[SLO: P-09-10-N-16] Take steps to avoid systematic error in specific context of the experiment.	Formative for PBA	Application	Question will not be asked in final examination of PBA. However, it will be part of Lab work.	
[SLO: P-09-10-N-17] Make measurements using common laboratory apparatus, such as millimeter scales, protractors, top-pan balances, newton meters, analogue or digital electrical meters, measuring cylinders, vernier calipers, micrometer screw gauges and thermometers.	Summative For Practical Based Assessment (PBA)	Application	Laboratory work- will be assessed in PBA	
[SLO: P-09-10-N-18] Use a stop-watch to measure intervals of time, including the period of an oscillating system by timing an appropriate number of consecutive oscillations.	Summative For Practical Based Assessment (PBA)	Application	Laboratory work- will be assessed in PBA	
[SLO: P-09-10-N-19] Use both analogue scales and digital displays. Be familiar with the following experimental contexts:	Summative For Practical Based Assessment (PBA)	Application	Laboratory work- will be assessed in PBA	
[SLO: P-09-10-N-20] Measurement of physical quantities such as length, volume or force.	Summative	Application	Laboratory work- will be assessed in PBA	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
	For Practical Based Assessment (PBA)			
[SLO: P-09-10-N-21] Measurement of small distances or short intervals of time.	Summative For Practical Based Assessment (PBA)	Application	Laboratory work- will be assessed in PBA	
[SLO: P-09-10-N-22] Determining a derived quantity such as the extension per unit load for a spring, the value of a known resistance or the acceleration of an object.	Summative For Practical Based Assessment (PBA)	Application	Laboratory work- will be assessed in PBA	
[SLO: P-09-10-N-23] Testing and identifying the relationship between two variables such as between the potential difference across a wire and its length.	Summative For Practical Based Assessment (PBA)	Application	Laboratory work- will be assessed in PBA	
[SLO: P-09-10-N-24] Comparing measured quantities such as angles of reflection.	Summative For Practical Based Assessment (PBA)	Understanding	Laboratory work- will be assessed in PBA	
[SLO: P-09-10-N-25] Comparing derived quantities such as density.	Summative For Practical Based Assessment (PBA)	Understanding	Laboratory work- will be assessed in PBA	
[SLO: P-09-10-N-26] Cooling and heating, including measurement temperature.	Summative For Practical Based Assessment (PBA)	Application	Laboratory work- will be assessed in PBA	
[SLO: P-09-10-N-27] Experiments using springs and balances.	Summative For Practical Based Assessment (PBA)	Application	Laboratory work- will be assessed in PBA	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO: P-09-10-N-28] Timing motion or oscillations.	Summative For Practical Based Assessment (PBA)	Application	Laboratory work- will be assessed in PBA	
[SLO: P-09-10-N-29] Electric circuits, including the connection and reconnection of these circuits, and the measurement of current and potential difference.	Summative For Practical Based Assessment (PBA)	Understanding	Laboratory work- will be assessed in PBA	
[SLO: P-09-10-N-30] Optics experiments using equipment such as optic pins, mirrors, prisms, lenses, glass or Perspex blocks (both rectangular and semicircular), including the use of transparent, translucent and opaque substances to investigate the transmission of light.	Summative For Practical Based Assessment (PBA)	Application	Laboratory work- will be assessed in PBA	
[SLO:P-09-10-N-31] Procedures using simple apparatus, in situations where the method may not be familiar to the candidate.	Formative for Practical Based Assessment	Application	Question will not be asked in final examination however, it will be part of Lab work.	
Benchmark II: Tabulate and graph data appropriately. Use the below good practices in tabulating data:				
[SLO: P-09-10-N-32] Record measured and calculated quantities with correct units accompanying them.	Formative for Practical Based Assessment	Application	Question will not be asked in final examination of PBA however, it will be part of Lab work.	
[SLO: P-09-10-N-33] Organise tabulated results with the following elements present: the heading of each column, the name or symbol of the measured or calculated quantity, together with the appropriate unit.	Formative for Practical Based Assessment	Application	Question will not be asked in final examination of PBA however, it will be part of Lab work.	
Use the below good practices in drawing graphs:				
[SLO: P-09-10-N-34] Label axes with quantities and units.	Formative for Practical Based Assessment	Application	Question will not be asked in final examination of PBA	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
			however, it will be part of Lab work.	
[SLO: P-09-10-N-35] Use scales for the axes that allow the majority of the graph paper to be used in both directions, and be based on sensible ratios, e.g. 2cm on the graph paper representing 1, 2 or 5 units of the variable (or10, 20 or 50, etc.).	Formative for Practical Based Assessment	Application	Question will not be asked in final examination of PBA however, it will be part of Lab work.	
[SLO: P-09-10-N-36] Plot data points to an accuracy of better than one half of one of the smallest squares on the grid.	Formative for Practical Based Assessment	Application	Question will not be asked in final examination of PBA however, it will be part of Lab work.	
[SLO: P-09-10-N-37] Plot data points using small crosses or fine dots with a circles drawn around them.	Formative for Practical Based Assessment	Application	Question will not be asked in final examination of PBA however, it will be part of Lab work.	
[SLO: P-09-10-N-38] Use measuring instruments to their full precision.	Formative for Practical Based Assessment	Application	Question will not be asked in final examination of PBA however, it will be part of Lab work.	
[SLO: P-09-10-N-39] Estimate the number of significant figures for calculated quantities as being the same as the least number of significant figures in the raw data used.	Formative for Practical Based Assessment	Application	Question will not be asked in final examination of PBA however, it will be part of Lab work.	
Standard: Students should be able to interpret and evaluate experimental observation and data **Benchmark I: Analyze plotted linear graphs and tables**				
[SLO: P-09-10-N-40] Show clear working in calculations, and key steps in reasoning.	Formative for Practical Based Assessment	Application	Question will not be asked in final examination of PBA however, it will be part of Lab work.	
[SLO: P-09-10-N-41] Express calculated ratios as decimal numbers, of two or three significant figures.	Formative for Practical Based Assessment	Application	Question will not be asked in final examination of PBA	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
			however, it will be part of Lab work.	
[SLO: P-09-10-N-42] Sketch lines of best fit with an equal number of points on either side of the line over its entire length (the points should not be seen to lie all above the line at one end, and all below the line at the other end).	Formative for Practical Based Assessment	Application	Question will not be asked in final examination of PBA however, it will be part of Lab work.	
[SLO: P-09-10-N-43] Convey the calculations for the gradient of a straight line by using a triangle whose hypotenuse extends over at least half the length of the plotted graph line.	Formative for Practical Based Assessment	Application	Question will not be asked in final examination of PBA however, it will be part of Lab work.	
[SLO: P-09-10-N-44] Determine the intercept of a straight-line graph.	Formative for Practical Based Assessment	Understanding	Question will not be asked in final examination of PBA however, it will be part of Lab work.	
[SLO: P-09-10-N-45] Take readings from graphs by extrapolation.	Formative for Practical Based Assessment	Application	Question will not be asked in final examination of PBA however, it will be part of Lab work.	
Standard: Students should be able to evaluate methods and suggest possible improvements **Benchmark |: Evaluate and suggest improvements regarding whether an experimental design:** **- is valid and reliable** **- has sources of error that could be better mitigated** **- is safe to conduct**				
[SLO: P-09-10-N-46] Identify whether an experimental procedure has validity (whether the results really do represent what they are supposed to measure) regarding the hypothesis being tested, and suggest changes to ensure validity as appropriate.	Formative for Practical Based Assessment	Application	Question will not be asked in final examination of PBA however, it will be part of Lab work.	

NCP SLOs Description	Form of Assessment	Cognitive Level	Remarks	Number of PeriodsRequired (1 period=40 minutes)
[SLO: P-09-10-N-47] Identify whether an experimental procedure reliable (whether the results can be reproduced under the same conditions), and suggest changes to ensure reliability as appropriate.	Formative for Practical Based Assessment	Application	Question will not be asked in final examination of PBA however, it will be part of Lab work.	
[SLO: P-09-10-N-48] Recommend how to mitigate sources of random and systematic error inherent in the given experimental design.	Formative for Practical Based Assessment	Application	Question will not be asked in final examination of PBA however, it will be part of Lab work.	
[SLO: P-09-10-N-49] Identify unsafe procedure in an experimental design and suggest ways to mitigate any hazards.	Formative for Practical Based Assessment	Application	Question will not be asked in final examination of PBA however, it will be part of Lab work.	

Note: The experiments or list of practicals will be extracted from the SLOs for Practical Based Assessment.

Note: PBA STANDS FOR "PRACTICAL BASED ASSESSMENT"

Federal Board SSC-II Examination
Physics Model Question Paper

(National Curriculum of Pakistan 2022-2023)
(Scheme of Studies 2006)

ROLL NUMBER					
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④	④	④	④	④	④
⑤	⑤	⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥	⑥	⑥
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⑧	⑧	⑧	⑧
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Section - A (Marks 12)

Time Allowed: 20 minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/ overwriting is not allowed. *Do not use lead pencil.*

Candidate Sign._____ **Invigilator Sign**. _____

Q1. Fill the relevant bubble against each question according to curriculum. Each part carries one mark.

Sr #	Question	(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)
1.	When light waves pass from air to glass and undergo refraction, which property does remain constant?	Direction	Speed	Frequency	Wavelength	O	O	O	O
2.	A student rubs a plastic rod with a cloth. The rod becomes positively charged. What has happened to the rod?	It has gained electron	It has gained proton	It has lost proton	It has lost electron	O	O	O	O
3.	Which group of two logic gates has HIGH output when both of their inputs are HIGH?	AND and OR	AND and NOR	NAND and NOR	NAND and OR	O	O	O	O
4.	A girl warms her hands by holding them near a fire. Using heat transfer principles, tell how the heat reaches her hands.	Conduction only	Conduction and convection	Radiation only	Convection and radiation	O	O	O	O
5.	Force on a current carrying conductor will be maximum if angle between rod and magnetic field is:	90^0	45^0	0^0	180^0	O	O	O	O
6.	A current of 1 ampere is drawn by a filament of bulb. Number of electrons passing through a cross-section of the filament in 16 seconds would be:	10^{20}	10^{19}	10^{-20}	10^{-19}	O	O	O	O

7.	Relation between coefficient of linear and volume expansion is:	$\alpha = 3\beta$	$\alpha = \beta/3$	$\beta = \alpha/3$	$\beta = \alpha$	O	O	O	O
8.	Which of the following has more ionization power?	Alpha-particle	Beta -particle	Gamma ray	Neutrons	O	O	O	O
9.	Which of the following characteristics of a wave is independent of others?	Speed	Frequency	Amplitude	Wavelength	O	O	O	O
10.	In a DC motor, commutators are in motion. Which of the following remains unaffected by their movement?	Current	Direction of forces	Direction of torque	Position of commutators with carbon brushes	O	O	O	O
11.	Sound travels faster in:	Plastic	Steel	Air	Oil	O	O	O	O
12.	What happens to an ordinary silicon diode when it is forward biased?	It conducts electricity	It blocks electricity	It emits light	It stores energy	O	O	O	O

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Time allowed: 2.40-hour **Total Marks Sections B and C: 53**

Note: Answer all parts from Section 'B' and all questions from Section 'C' on the **E-sheet**. Write your answers on the allotted/given spaces.

SECTION – B (Marks 33)

Q.2 Answers the following questions briefly. **(11x3 = 33)**

Q. 2	Questions	Marks		Questions	Marks
(i)	What is meant by isotope of an element? Give examples of three isotopes of any element.	03	**OR**	What is meant by specific heat capacity of a substance? Write its formula and SI unit.	03
(ii)	Define electric field. How is it expressed mathematically? Is it a vector quantity?	03	**OR**	What is meant by biasing of a diode? What are types of biasing?	03
(iii)	How do longitudinal waves differ from transverse waves? Give some real-life examples of longitudinal and transverse waves.	03	**OR**	Two identical batteries, each with an emf of 1.5V, are connected (a) in series and (b) in parallel. Calculate the total emf in each case.	03
(iv)	What is the cost of running four light bulbs of 100 watts each for 6 hours in a school for a month? Cost of electricity unit is Rs. 12 per kWh.	03	**OR**	Calculate the speed of light in a medium of refractive index 1.5.	03
(v)	With the help of an example, show that Lenz's law follows conservation of energy.	03	**OR**	How are electrical energy and electrical power related? How can you calculate each one in a simple electric circuit?	03
(vi)	Elaborate the differences between alternating current and direct current by using current-time graphs.	03	**OR**	How do land and sea breezes form, and what role do temperature difference between land and sea water play in these breezes?	03
(vii)	What is an echo? Calculate the minimum distance between source and obstacle to hear echo in air? (speed of sound in air = 340 m/s).	03	**OR**	What are the common methods used to discharge an insulator? Briefly elaborate any one method.	03
(viii)	What is the electromagnetic spectrum? Give its order based on frequency of radiation.	03	**OR**	Define ohm's law. What are its limitations?	03
(ix)	A radioactive substance has a half-life of 6 hours. Its initial amount is 300 grams. Calculate the amount left after 18 hours.	03	**OR**	A convex lens with a focal length of 10 cm produces a linear magnification of 3. A 5 cm tall object is placed 30 cm in front of it. Calculate the image distance and the height of the image formed.	03
(x)	When will a converging lens act as a magnifying glass? Show it by a ray diagram.	03	**OR**	How does the wavelength of a wave change if its frequency is doubled in a medium while its speed remains constant?	03
(xi)	Differentiate between evaporation and boiling of liquids.	03	**OR**	Why does the sky appear blue during the day?	03

SECTION – C (Marks 20) **Note:** Attempt all questions. Marks of each question are given.					
Q.3	What is conduction? Explain it on the basis of kinetic theory of solids. What makes metals better conductors than other substances?	05	**OR**	What is nuclear fusion reaction? Write down steps involved in proton- proton cycle. What is cause of energy in nuclear fusion?	05
Q.4	Draw a comparative sketch illustrating the loudness and pitch of sound waves. Also give their brief description.	05	**OR**	Explain the phenomenon of total internal reflection. What are necessary conditions of total internal reflection? Derive formula for refractive index of a medium in term of critical angle.	05
Q.5	A solid cube of side length 5cm at $15C^0$ is heated. Calculate its (a) initial volume (b) increase in its volume (c) final volume at $100C^0$. (Coefficient of volume expansion of this solid is $9\times10^{-6}\ K^{-1}$).	05	**OR**	Three resistors 5Ω, 10 Ω and 15 Ω are connected in parallel combination across 30V battery. Calculate the equivalent resistance, total current and current across each resistor?	05
Q.6	What is meant by transformer? Explain the working of a simple iron-cored transformer. Give transformer equation.	05	**OR**	Differentiate between digital and analogue electronics. What makes digital system better than an analogue system?	05

FBISE SSC-II Examination

Physics Model Question Paper

(Curriculum 2022-23)

Alignment of Questions with Curriculum Student Learning Outcomes

Sr No	Section: Q. No. (Part no.)	Domain Title/ Content Area	Student Learning Outcomes	Cognitive Domain *	Allocated Marks in Model Paper
1	A: Q1(1)	Domain D	[SLO: P-10-D-36] Apply the qualitative principle that a wave refracts towards the normal when it slows down while entering a medium, and it refracts away from the normal if it speeds up when it enters a new medium [in the case the angle of incidence is zero, then the waves continue parallel to the normal].	U	1
2	A: Q1(2)	Domain E	[SLO: P-10-E-04] Explain that charging of solids by friction involves only a transfer of negative charge (electrons).	U	1
3	A: Q1(3)	Domain E	[SLO: P-10-E-65] State in words and in truth table form, the action of logic gates [specifically of AND, OR, NAND, NOR and NOT.	K	1
4	A: Q1(4)	Domain C	[SLO: P-10-C-41] Analyze everyday applications of conduction, convection and radiation [Including: (a) heating objects such as kitchen pans (b) heating a room by convection (c) measuring temperature using an infrared thermometer (d) using thermal insulation to maintain the temperature of a liquid and to reduce thermal energy transfers in buildings (e) the mechanism of a household hot-water system]	A	1
5	A: Q1(5)	Domain E	[SLO: P-10-E-82] Describe an experiment to show that a force acts on current carrying conductor in a magnetic field. [including the effect of reversing: (a) the current (b) the direction of the field]	U	1
6	A: Q1(6)	Domain E	[SLO: P-10-E-20] Define and calculate electric current [Use the equation electric current = charge/time I = Q/t to solve simple problems.	A	1
7	A: Q1(7)	Domain C	[SLO: P-10-C-09] Describe qualitatively the thermal expansion of solids [linear and volumetric expansion].	K	1
8	A: Q1(8)	Domain F	[SLO: P-10-F-10] Justify qualitatively the order of strength for α - particles, β - particle and γ - radiation in terms of their: (a) their relative ionizing effects (b) their relative penetrating powers	K	1
9	A: Q1(9)	Domain D	[SLO: P-10-D-03] Describe the features of a wave [in terms of wave front, wavelength, frequency, time period, crest (peak), trough, compression, rarefaction, amplitude and wave speed].	K	1
10	A: Q1(10)	Domain E	[SLO: P-10-E-86] Describe the operation of an electric motor, including the action of a split-ring commutator and brushes.	U	1
11	A: Q1(11)	Domain D	[SLO: P-10-D-22] Describe that, in general, sound travels faster in solids than in Liquids and faster in liquids than in gasses.	K	1

12	A: Q1(12)	Domain E	[SLO: P-10-E-45] Describe the working of a diode.	U	1
13	B: Q2(i)	Domain F Domain C	[SLO: P-10-F-05] Explain what is meant by an isotope and state that an element may have more than one isotope. OR [SLO: P-10-C-01] Define and calculate specific heat.	K	3
14	B: Q2(ii)	Domain E Domain E	[SLO: P-10-E-09] Describe an electric field as a region in which an electric charge experiences a force. OR [SLO: P-10-E-45] Describe the working of a diode.	K	3
15	B: Q2(iii)	Domain D Domain E	[SLO: P-10-D-06] Illustrate that for a transverse wave, the direction of vibration is at right angles to the direction of the energy transfer. [SLO: P-10-D-07] Illustrate that for a longitudinal wave, the direction of vibration is parallel to the direction of the energy transfer. OR [SLO: P-10-E-30] Calculate the total e.m.f. where several sources are arranged in series. [SLO: P-10-E-31] State that the e.m.f of identical sources connected in parallel is equal to the e.m.f. of one of the sources.	U	3
16	B: Q2(iv)	Domain E Domain D	[SLO: P-10-E-54] Calculate the cost of using electrical appliances where the energy unit is the kWh. OR [SLO: P-10-D-37] Define and use the refractive index from a vacuum to a medium for Light as c/v.	A	3
17	B: Q2(v)	Domain E Domain E	SLO: P-10-E-76] Use the fact that the effect of the current produced by an induced e.m.f. is to oppose the change producing it (Lenz's law). OR [SLO: P-10-E-50] Use the equation, power = current ×voltage P = IV to solve simple Problems. [SLO: P-10-E-51] Use the equation energy = current x voltage x time E = IVt to solve simple problems.	U	3
18	B: Q2(vi)	Domain D Domain C	SLO: P-10-E-23] Differentiate between direct current (d.c.) and alternating current (a.c.). OR [SLO: P-10-C-34] Describe the role of land breezes and sea breezes in maintaining moderate coastal climates.	U	3
19	B: Q2(vii)	Domain D Domain E	[SLO: P-10-D-18] Describe an echo as the reflection of sound waves. OR SLO: P-09-E-05] Explain how and why an insulator can be discharged by (a) putting it above a flame, and (b) exposing it to damp conditions.	U	3
20	B: Q2(viii)	Domain C Domain E	[SLO: P-10-E-94] state the main regions of the electromagnetic spectrum in order of frequency and in order of wavelength. OR [SLO: P-10-E-34] Define and apply Ohm''s law [Including reference to constant temperature. Use the equation resistance = p.d./current R = V/I to solve simple problems].	A	3
21	B: Q2(ix)	Domain F	[SLO: P-10-F-17] Define and infer the half-life of materials [Half-life as the time taken for half the nuclei of an isotope in any sample to decay. Use this definition of half-life in calculations, which may	A	3

		Domain D	involve information tables or decay curves]. OR [SLO: P-10-D-49] Define and calculate linear magnification [as the ratio of image length to object length; state and use the equation linear magnification = image length/object length].		
22	B: Q2(x)	Domain D Domain D	[SLO: P-10-D-48] Differentiate a magnifying glass between real and virtual images. OR SLO: P-10-D-05] Recall and apply the equation wave speed = frequency ×Wavelength (v =f×λ).	U	3
23	B: Q2(xi)	Domain F Domain E	[SLO: P-10-C-12] Differentiate between boiling and evaporation. OR [SLO: P-10-E-98] Explain qualitatively, how scattering of light by molecules in the air give the sky its blue color during the day and its shades of red during sunset [use of the terms Rayleigh and Mei scattering are not required].	U	3
24	C: Q3	Domain D Domain F	[SLO: P-10-C-31] Explain thermal conduction in all solids [in terms of atomic or molecular lattice vibrations and also in terms of the movement of free (delocalized) electrons in metallic conductors]. OR [SLO: P-10-F-14] Describe nuclear reactions (fission & fusion) with examples [fusion as the formation of a larger nucleus by combining two smaller nuclei with the release of energy, and recognize fusion as the energy source for stars].	K	7
25	C: Q4	Domain D Domain D	[SLO: P-10-D-16] Describe how changes in amplitude and frequency affect the loudness and pitch of sound waves. OR [SLO: P-10-D-40] Define the terms critical angle and total internal reflection [SLO: P-10-D-41] Derive the equation n = 1/sin (c).	U	5
26	C: Q5	Domain C Domain E	[SLO: P-10-C-09] Describe qualitatively the thermal expansion of solids [linear and volumetric expansion]. OR [SLO: P-10-E-40] Calculate the combined resistance of two resistors in parallel.	A	5
27	C: Q6	Domain E Domain E	[SLO: P-10-E-88] Explain the principle of operation of a simple iron-cored transformer. OR SLO: P-10-E-73] Compare analogue and digital electronics.	U	5

K: Knowledge U: Understanding A: Application

Table of Specification Model Paper Physics – Grade X

Domain	**Heat and Thermodynamics C**		**Waves D**			**Electricity and magnetism E**						**Modern Physics F**		
Assessment Objectives	Heat Capacity And Modes of Heat transfer	Thermal Expansion and Change of state	Waves	Sound	Optics	Electrostatics	Current Electricity	Electric circuits	Electronics	Electro-magnetism	Electro-magnetic waves	Nuclear physics	Total arks	Percentage
K Knowledge	Q2(i/s)3 Q3(f)5	Q1(7)1	Q1(9)1	Q1(11)1		Q2(ii/f)3	Q2(viii/s)3		Q1(3)1 Q2(ii/s)3		Q2(viii/f)3	Q1(8)1 Q2(i/f)3 Q3(s)5	33	28%
U Understanding	Q2(vi/s)3	2(xi/f)3	Q2(iii/f)3 Q2(x/s))3	Q2(vii/f)3 Q4(f)5	Q1(1)1 Q2(x/f)3 Q4(s)5	Q1(2)1 Q2(vii/s)3	Q2(iii/s)3 Q2(vi/f)3	Q2(v/s)3	Q1(12)1 Q6(s)5	Q6(f)5 Q1(10)1 Q1(5)1 Q2(v/f)3	Q2(xi/s)3		61	51.7%
A Application	Q1(4)1	Q5(f)5			Q2(iv/s)3 Q2(ix/s)3		Q1 (6)1	Q5(s)5 Q2(iv/f)3				Q2(ix/f)3	24	20.3%
Total Marks	12	9	7	9	15	7	10	11	10	10	6	12	118	
Total Percentages	10.1%	7.6%	6%	7.6%	12.7%	6%	8.5%	9.3%	8.5%	8.5%	5.1%	10.1%		100%

Note:

1 This ToS does not reflect policy, but it is particular to this model question paper.

2 Proportionate / equitable representation of the content areas as per the defined ranges may be ensured.

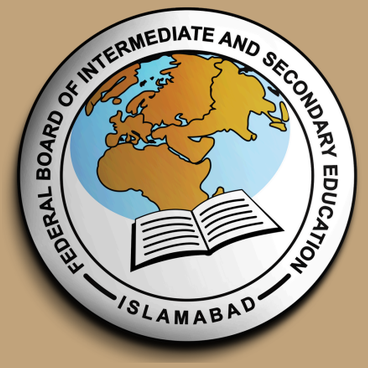
3 The percentage of cognitive domain is 30%, 50%, and 20% for knowledge, understanding, and application, respectively with **± 5%** variation.

4 While selecting alternative questions for SRQs and ERQs, it must be kept in mind that:

- Difficulty levels of both questions should also be same
- SLOs of both the alternative questions must be different

Key: Question Number (part/ first choice) marks example: Q2 (i / f) 2

Question Number (part/ second choice) marks example: Q2 (i / s) 2



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