KISII UNIVERSITY

DEPARTMENT OF PHYSICS

PROGRAMS OFFERED

1 UNDERGRADUATE DEGREE

1.1 Bachelor of Science in Physics

1.1.1 Introduction

A Bachelor of Science in Physics of Kisii University is an undergraduate academic degree program that focuses on the study of the fundamental principles governing the behavior of matter and energy in the universe. Physics is a branch of science that seeks to understand the natural world at its most fundamental level and is a cornerstone of modern scientific research and technological development.

During a Bachelor of Science in Physics program, students typically engage in a combination of theoretical and practical coursework. They study topics such as classical mechanics, electromagnetism, thermodynamics, quantum mechanics, relativity, optics, and more. The program often includes laboratory work, where students gain hands-on experience conducting experiments and verifying theoretical concepts.

Here are some key aspects of a Bachelor of Science in Physics program:

1. **Core Concepts:** Students develop a strong foundation in the principles of physics, exploring how matter and energy interact and the mathematical models used to describe these interactions.

2. **Mathematical Rigor:** Physics heavily relies on mathematics to describe and predict natural phenomena. Students build and refine their mathematical skills, using calculus, differential equations, linear algebra, and other mathematical tools.

3. **Laboratory Work:** Hands-on experimentation is a vital component of a physics degree. Students learn to design, conduct, and analyze experiments, enhancing their problem-solving and critical-thinking abilities.

4. **Theoretical Understanding:** Students delve into various branches of physics, including classical mechanics (motion and forces), electromagnetism (electricity

and magnetism), thermodynamics (heat and energy transfer), quantum mechanics (behavior of particles at the atomic and subatomic levels), and more.

5. **Interdisciplinary Connections:** Physics has applications in diverse fields, from engineering to medicine, astronomy to material science. Students may explore interdisciplinary connections and the real-world implications of physics concepts.

6. **Computational Skills:** Modern physics often involves complex simulations and computational modeling. Students may learn programming and numerical techniques to simulate physical systems and analyze data.

7. **Critical Thinking:** Physics encourages analytical thinking and problem-solving skills. Students learn to approach complex problems methodically and derive logical solutions.

1.1.2 Career Paths and potential area of employment

A Bachelor of Science (B.Sc.) in Physics opens up a wide range of career paths, both within the field of physics itself and in various related industries. Here are some potential career paths for individuals with a degree in physics:

1. **Research Scientist:** With a bachelor's degree in physics, you can work as a research scientist in academic, government, or industrial research settings. You might be involved in conducting experiments, analyzing data, and contributing to the advancement of scientific knowledge.

2. **Laboratory Technician:** You could work as a laboratory technician in various industries, including electronics, materials science, and medical research. Your role would involve setting up experiments, operating equipment, collecting data, and maintaining lab equipment.

3. **Data Analyst:** Physics graduates often have strong analytical and problem-solving skills, which are highly valued in data analysis and data science roles. You could work with companies to analyze and interpret data, make predictions, and provide insights for decision-making.

4. **Science Communication:** If you enjoy explaining complex concepts to others, you might pursue a career in science communication. This could involve writing articles, creating videos, hosting podcasts, or working as a science journalist to make scientific information accessible to the public.

5. **Teaching:** With further education and certification, you can become a high school physics teacher or even a college-level instructor. Teaching allows you to share your passion for physics and inspire the next generation of scientists.

6. **Engineering:** Many physics graduates transition into engineering roles, especially those related to electronics, telecommunications, energy, and

aerospace. Physics provides a strong foundation for understanding the underlying principles in these fields.

7. **Software Development:** Physics graduates with programming skills can work in software development, especially in industries that require simulation and modeling, such as computer graphics, simulations, and computational physics.

8. **Financial Analysis:** The quantitative and analytical skills acquired during a physics degree can be valuable in financial analysis roles. You could work in investment firms, analyzing market trends, risk assessment, and financial modeling.

9. **Medical Physics:** If you're interested in healthcare, you could work in medical physics, which involves applying physics principles to areas like radiation therapy, medical imaging, and diagnostics.

10. **Environmental Science:** Physics skills can be useful in understanding and addressing environmental issues. You could work on climate modeling, renewable energy research, or environmental monitoring.

11. **Space and Astronomy:** If you're passionate about space, you might work in space agencies, observatories, or private companies focusing on space exploration, satellite development, or astrophysics research.

1.1.3 Entry Requirements for the Programme:

1. All candidates admitted to the B.Sc. In Physics degree programme must satisfy the minimum entry requirements stipulated in the common university entrance regulations.
2. The candidate must have passed the Kenya Certificate of Secondary Education (KCSE) with the minimum grades as indicated in the following subjects:

   Physics: C+; Chemistry: C+; Mathematics: C+
3. Those holding qualifications equivalent to the above from institutions recognized by Kisii University (KSU) Senate may also be admitted.
4. Admission may also be offered to outstanding Diploma holders in Physical Sciences with a bias towards Physics and who have passed with a credit or above or their equivalents. Such cases will be considered on a case by case merit.
5. holders of KCSE certificate or equivalent with a minimum of C+ and lacking cluster subjects (Physics and two science subjects as in (i) above) may be considered after bridging the failed subjects. The Candidates must score at least a C-plain in the subject they are bridging.
6. A holder of KACE certificate or equivalent with minimum of two principal passes and lacking O-level cluster subject grades. The candidate must score at least C-Plain in the subject they are bridging.

1.2 Bachelor of Science in Geophysics and Mineralogy

1.2.1 Introduction

Geophysics is the application of physics principles to the study of the Earth. It is an engineering course that images the Earth's interior for economic resource identification and location. Geophysics also provides the nature of the Earth's subsurface before construction of any engineering structure commences (such as buildings, roads, railway etc). **Mineralogy** is the science of minerals.

This course entails the study of the geophysical techniques such as potential fields (gravity and magnetics), diffusive fields (electrical, heat flow, electromagnetics), and wave propagation (seismic waves, radar waves, and GIS). These methods are widely applied in exploration and production in petroleum industry, geothermal energy, underground water, geotechnical engineering, oil and gas industry. Furthermore, applied in exploration, production and processing of minerals such as (iron, gold, diatomite etc) which are important in construction and medical fields.

B.Sc. Geophysics and Mineralogy is designed to meet challenges and demands affecting Kenya's labor market as dictated by both local and international demands. The program is also designed to combat shortage of professionals trained in Geophysics and Mineralogy in Kenya, Africa region and the world at large. The course is designed to provide interdisciplinary approaches for training Geophysics and Mineralogy engineers and scientists who need to work competitively in all fields and areas in this sector. The course provides graduates with real world situations full of various techniques of analysis, knowledge, skills, attitudes, and experiences that prepare them to meet challenges in the fields of Geophysics and Mineralogy.

Geophysics and mineralogy equips scholars with substantial understanding of a wide range of sciences in demonstrating technical competence in planning, conducting and reporting on investigations, collect, record and analyze data using appropriate analytical techniques in the field and laboratory. Geophysicist apply knowledge and understanding to address issues of mineral prospecting, quantification and processing as well as issues relating to the surrounding communities as far as minerals are concerned. It also develops advanced knowledge on geophysical data acquisition, processing and interpretation.

1.2.2 Career paths:

- Geophysicist
- Mineralogist
- Geoscientist

1.2.3 Potential area of employment:

Here are some potential areas of employment for graduates in Geophysics and Mineralogy fields:

1. **Oil and Gas Industry:** Geophysics graduates can work in exploration and production companies, using seismic surveys and other geophysical methods to locate and assess oil and gas reserves underground.

2. **Mining Industry:** Both geophysics and mineralogy graduates can work in the mining sector, exploring and evaluating mineral deposits, analyzing their composition, and developing strategies for efficient extraction.

3. **Environmental Consulting:** Geophysics graduates can contribute to environmental assessments and site investigations, using their knowledge to study soil and water contamination, groundwater flow, and other subsurface issues.

4. **Geotechnical Engineering:** Graduates can work in this field, assessing the stability of soil and rock for construction projects, designing foundations, and ensuring the safety of infrastructure.

5. **Natural Resource Management:** Geophysics and mineralogy graduates can play a role in managing and conserving natural resources, assessing their availability, and monitoring their sustainable extraction.

6. **Geothermal Energy Industry:** Geophysics graduates can work in the exploration and development of geothermal energy resources, using their knowledge to locate suitable areas for geothermal power generation.

7. **Environmental Monitoring:** Both geophysics and mineralogy graduates can contribute to monitoring natural disasters such as earthquakes, landslides, and volcanic eruptions, helping to mitigate their impacts.

8. **Research and Academia:** Graduates can pursue research and teaching positions in universities and research institutions, advancing the understanding of Earth's processes, materials, and resources.

9. **Remote Sensing and GIS:** Geophysics graduates can work with geographic information systems (GIS) and remote sensing technologies to analyze and map geospatial data for various applications, including urban planning, agriculture, and natural resource management.

10. **Hydrology and Water Resource Management:** Geophysics graduates can contribute to the study of groundwater systems, water availability, and water quality assessment, which are critical for sustainable water resource management.

11. **Government Agencies:** Graduates can work for government agencies responsible for land and resource management, environmental protection, and geological surveying.

12. **Consulting Firms:** Graduates can find employment in consulting firms that offer services in geophysics, mineralogy, and environmental assessments to a wide range of industries.

13. **Energy Companies:** Geophysics graduates may work in renewable energy sectors such as wind and solar energy, where subsurface studies can help identify suitable locations for installations.

1.2.4 Entry requirement

To be eligible for admission for this course, a candidate must satisfy the following requirements:

- All candidates admitted to the degree programme of B.Sc. Geophysics and Mineralogy must satisfy the minimum university entry requirements stipulated in the common university entrance requirement regulations of C+ (plus) and above.
- Candidates must have passed the Kenya Certificate of Secondary Education (KCSE) examination with minimum grade indicated in each of the following subjects:
    - Chemistry/Physics C+ (or B in Physical Sciences)
    - Mathematics C +
    - Biology or Geography C+ (or B in Biological Sciences)

Those with diploma qualifications in the following areas can also be considered: Geophysics, Mineralogy, Analytical Chemistry, Biological Sciences, and any other qualification that the Senate may deem equivalent to the above.

1.3 Bachelor of Science in Renewable energy

1.3.1 Introduction

World's energy demand has continued to grow over the past half century owing to high increase in population and industrial advancement. About 80% percent of this energy comes from none renewable energy sources such as oil, coal and natural gases. Over years, these energy sources will be depleted resulting in energy crisis. It is from this perspective that the world energy today is moving in the direction of renewable energy sources such as solar energy, geothermal energy, wind energy, Biomass energy and hydro energy. For maximum extraction, distribution and proper utilization of this energy, scientist with vast knowledge in this area required. It is for this reason that Bachelor of Science in Renewable Energy of Kisii University was developed.

The course is aimed at equipping the graduates with high theoretical and technical skills to allow them work competently in various renewable energy firms as technicians, analysts, consultants among other positions within these firms. Through this course, graduates will also acquire appropriate skills and knowledge to allow them to advance their renewable energy career at postgraduate level. It is at this level that research students will have an opportunity to develop efficient systems for maximum harnessing of energy from the various renewable energy sources. A good example of this is the significant advancement in the design of solar cells that have enhanced efficiency of solar modules.

1.3.2 Career paths:

Graduates of renewable energy will become expert in all sectors dealing with renewable energy. These include solar energy, wind energy, Geothermal Energy, Bio-energy and energy storage among others

1.3.3 Potential area of employment:

A graduate with a degree in renewable energy can find employment opportunities in a wide range of sectors and industries that are focused on sustainable and clean energy solutions. Here are some potential areas where a renewable energy graduate can be employed:

1. **Renewable Energy Companies:** Many companies specialize in developing, manufacturing, and implementing renewable energy technologies such as solar, wind, hydro, geothermal, and bioenergy systems. Graduates can work in research and development, project management, engineering, and more.
2. **Energy Consultancies:** Consulting firms provide expertise to businesses, governments, and organizations seeking to transition to renewable energy sources. Graduates can offer advice on energy efficiency, policy analysis, project feasibility, and sustainability strategies.
3. **Utilities and Power Companies:** Traditional power companies are increasingly integrating renewable energy sources into their energy mix. Graduates can work in areas like energy planning, grid integration, and managing renewable energy projects.
4. **Government and Regulatory Agencies:** Governments worldwide are investing in renewable energy to meet climate goals. Graduates can work in regulatory bodies, energy ministries, and environmental agencies to develop policies, incentives, and regulations for renewable energy adoption.
5. **Research and Development Institutes:** Research institutions and universities conduct studies to advance renewable energy technologies. Graduates can engage in research, innovation, and development of new renewable energy solutions.
6. **Construction and Engineering Firms:** Companies that build renewable energy projects, such as solar farms, wind parks, and hydropower facilities, require engineers and project managers with expertise in renewable energy systems.

7. **Manufacturing and Supply Chain:** Manufacturing companies produce components and systems for renewable energy technologies. Graduates can be involved in manufacturing, quality control, supply chain management, and product development.
8. **Energy Storage Companies:** Energy storage is a critical aspect of integrating intermittent renewable sources into the grid. Graduates can work on developing and implementing energy storage solutions like batteries, pumped hydro storage, and more.
9. **Environmental Organizations:** Non-governmental organizations (NGOs) and environmental advocacy groups often work on promoting renewable energy adoption. Graduates can contribute to awareness campaigns, policy advocacy, and community engagement.
10. **Startups and Entrepreneurship:** The renewable energy sector continues to evolve, creating opportunities for startups to develop innovative solutions. Graduates with entrepreneurial spirit can start their own companies focused on renewable energy products or services.
11. **Finance and Investment Firms:** As renewable energy projects require significant investment, finance and investment professionals are needed to fund these initiatives. Graduates can work in roles related to project financing, risk assessment, and sustainable investing.
12. **Energy Efficiency and Building Design:** Graduates can work with architects and engineers to design energy-efficient buildings and systems, incorporating renewable energy technologies like solar panels and efficient HVAC systems.
13. **Transportation and Electric Vehicles:** The transportation sector is shifting towards electric vehicles (EVs) and sustainable transportation solutions. Graduates can work on EV infrastructure, charging networks, and related technologies.
14. **Smart Grid and Energy Management:** Smart grid technologies optimize the integration of renewable energy sources and improve energy efficiency. Graduates can work on grid management, energy monitoring systems, and demand response programs.

15. **International Development Organizations:** Organizations focused on global development may hire renewable energy experts to work on projects that bring clean energy solutions to underserved communities around the world.

These are just some of the many opportunities available to renewable energy graduates. The field is growing rapidly as the world seeks to transition to cleaner and more sustainable energy sources.

1.3.4 Entry Requirement

1. All candidates admitted to the B.SC. In Renewable Energy degree programme must satisfy the minimum entry requirements stipulated in the common university entrance regulations.
2. The candidate must have passed the Kenya Certificate of Secondary Education (KCSE) with the minimum grades as indicated in the following subjects:
   Physics: C+; Chemistry: C+; Mathematics: C+
3. Those holding qualifications equivalent to the above from institutions recognized by Kisii University (KSU) Senate may also be admitted.
4. Admission may also be offered to outstanding Diploma holders in Physical Sciences with a bias towards Physics and who have passed with a credit or above or their equivalents. Such cases will be considered on a case by case merit.
5. A holder of KCSE certificate or equivalent with a minimum of C+ and lacking cluster subjects (Physics and two science subjects as in (i) above). The Candidate must score at least a C-plain in the subject he/she is bridging in.
6. A holder of KACE certificate or equivalent with minimum of two principal passes and lacking O-level cluster subject grades. The candidate must score at least C-Plain the subject in which he/she is bridging in.

1.4 Lecturers in the department of Physics

Name	**Area of specialization**
Dr. Daniel Ketui	Electronics and Instrumentation
Dr. Calford Otieno	Theoretical Physics
Dr. Eric Rayora	Geophysics and Mineralogy
Dr. Willis Otieno	Nuclear Physics
Mr. Kefa Masore	Environmental Physics
Mr. Denis Ombati	Geophysics and Mineralogy
Mr. Enock Okiambe	Environmental Physics
Mr. Jared Agora	Theoretical Physics
Mr. Lewis Omwando	Renewable Energy