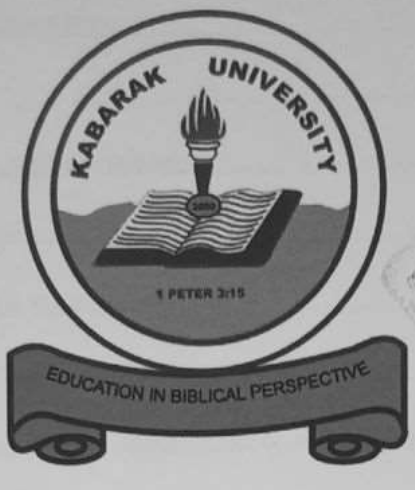

KABARAK UNIVERSITY

SCHOOL OF SCIENCE, ENGINEERING AND TECHNOLOGY

CURRICULUM

FOR

MASTER OF SCIENCE IN PHYSICS

Submitted to

COMMISSION FOR UNIVERSITY EDUCATION

NOVEMBER 2019

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2.0 THE CURRICULUM

2.1 Title of the Program

Master of Science in Physics

2.2 Philosophy of the Program

The goal of the proposed MSc program is to provide a graduate degree in Physics that prepares students to be highly employable across all sectors of the economy and for entry into doctoralPrograms. The Master of Science in Physics program is designed to produce scholars who will conduct top-tier, original research that makes a significant contribution to knowledge within the field of Physics. By the completion of the program, students are expected to demonstrate an in-depth understanding of the theoretical, conceptual, and research foundations of Physics. The faculty believe that in order to churn out well-groundedPhysicists, the core of the education of the Physicsat postgraduate level must contain courses which lay a strong theoretical, computational and experimental foundation. Therefore, the program is designed to include compulsory courses in Mathematical Methods for Physics, Classical Mechanics, Quantum Mechanics, Electrodynamics, Statistical Mechanics and laboratory techniques.

The program contributes in an integral way to Kabarak University's stated mission by delivering curricula and advancing scholarship and research in Biblical perspectives. Thus, the program includes a common unit (Metaphysics and Epistemology) which offer students with an opportunity to relate science with natural phenomena.

2.3 Rationale

2.3.1 Needs assessment/market survey/situation analysis;

This program proposal is largely motivated by recent data. According to reports from the American Institute of Physics (AIP) Statistical Research Centre, the number of institutions offering graduate physics studies has remained the same for several decades. Institutions in developing countries tend to shy away from graduate Programs in Physics due to cost implications. However, increased computational power is making it possible to study physics through virtualization and computationally in collaboration with institutions such as KENET and links with universities in developed countries such as South Africa and Italy. Latest surveys also return positive outlook for graduate physics in Africa. There is a drive to promote physical sciences and its applications in Africa by several groups such as MSSEESA, Institute of Physics, TWAS, ICTP, Kenya physics society, MRS among others.

2.3.2 Stakeholders Involvement/justification

Studies were conducted in firms and institutions of higher learning to establish the viability of the program. Online research was also conducted to assess the need for physicist globally and interviews were done with lecturers and students around Country. Results show that the MSc in Physics is in demand. A forum for stakeholders was organised on to discuss the curriculum. Also during industrial attachment, lecturers engaged employers/industrialists on new academic frontiers and areas of improvement in our Programs. The university then receives feedback in writing with recommendations.

A total of 78 firms were selected using random sampling methods. The marketing managers and IT specialists were the respondents who filled the questionnaires that we drop and picked later from their premises. The result of the study is summarized in the tables 1 below.

Table 1. Responses of Respondents to the need for Master of Science in Physics at the Kabarak University

	SD	D	SOD	N	SOMA	A	SA	CHISQ	P>CHISQ
Current training in Physics covers all training needs in physics?	1.99	20.9	21.4	23.38	21.39	3.98	6.97	75.8	<.0001
We need physics graduates in our country that can solve physical problems	1.49	8.46	3.98	20.4	29.35	18.41	17.91	84.2	<.0001
In the last 10 years, technology has grown and requires challenging minds to develop new materials to support the emerging technologies	6.47	3.48	3.98	9.95	28.86	24.38	22.89	97.2	<.0001
Even if intuitions abroad absorb our students for graduate studies, we still need institutions to offer them here.	1.49	2.49	0.5	7.46	32.84	11.94	43.28	243.4	<.0001
Research in MSc in Physics will benefit institutions of higher learning	0.5	1.5	2.5	13.5	15	26.5	40.5	186.2	<.0001
MSc physics contribute positively towards research and benefit industries in Kenya	1	1	3	14	11.5	32	37.5	187.8	<.0001
There is need for training in MSc physics that can enhance research output	1.52	1.01	3.03	15.66	15.66	24.75	38.38	160.8	<.0001

The respondents disagreed (SD=2, D=21, SOD=23, $\chi^2 = 75.8, P \leq 0.0001$) that the current training in graduate physics. They also agreed (SOMA=29, A=18, SA=18,

$\chi^2 = 84.2, P \leq 0.0001$) they need physics graduates in our country that can solve physical problems. The respondents agreed (SOMA=29, A=24, SA=23, $\chi^2 = 97.2, P \leq 0.0001$) that in the last 10 years, technology has grown and requires challenging minds to develop new materials to support the emerging technologies. Despite the fact that a number of respondents agreed that intuitions abroad absorb our students for graduate studies, they still need institutions to offer them here (43%, $\chi^2 = 243.4, P \leq 0.0001$). The respondents strongly agreed that launching a MSc in Physics could meet the current challenges.

2.4 Goal of the Program

The goal of the M.Sc. Physics program at Kabarak University is to prepare students for Ph.D. level work and advanced research in Physics and its applications. Students focus on the fundamentals, standard graduate level core courses and beginning research while being mentored by the faculty. The primary goal is to prepare students for a smooth transition into Ph.D. programs at Kabarak University and other institutions. The graduates of the program should be able to apply the knowledge gained to carry out independent research to advance practical or theoretical knowledge in physics. The students should also attain a perspective of wholeness in their personal lives and contribute positively to national development efforts.

2.5 Expected Learning Outcomes (ELO)

At the end of the program, a graduate of MSc in Physics should be able to:

1. Analyze the scientific knowledge of Physics for deeper understanding of the nature.
2. Identify, formulate, research literature, and analyze advanced scientific problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design solutions for advanced scientific problems and design system components or processes.
4. Discuss research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Conduct research to demonstrate the preparation and ability to engage in independent and life-long learning in the broadest context of scientific and technological change.

2.5.1 Specific Learning Outcomes (SLO):

At the end of the program, the student will be able to:

1. Discuss the principles of physics to demonstrate understanding of the scientific phenomenon in classical domain.
2. Compute mathematical techniques for describing and deeper understanding of physical systems.
3. Compute statistical methods for describing the classical and quantum particles in various physical systems and processes.
4. Perform the principles of Quantum mechanics for understanding the physical systems in quantum realm.

5. Conduct advanced experimental/theoretical methods for measurement, observation, and fundamental understanding of physical phenomenon/systems.
6. Engage in research and life-long learning to adapt to changing environment.
7. Identify suitable materials and techniques for applications in solar energy harnessing.
8. Create, select, and apply appropriate techniques, resources, and modern scientific and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
9. Conduct physics experiments to model climate and atmosphere to advance the understanding of the dynamics of atmosphere.

2.6 Mode of Delivery of the Program

The MSc in Physics program involves formal teaching and research. The program will be delivered through face to face method supported by ICT and e-learning tools. Students are integrated into the research culture of the Department by joining a research group. They are expected to attend the Department's program of research seminars and other graduate courses but most research training is provided within the group structure and overseen by their research supervisor. Informal opportunities to develop research skills also exist through mentoring and other opportunities by fellow students and members of staff.

The Program will be organized in such a manner that students admitted to program will opt for one of the following: Condensed Matter Physics, Instrumentation and Solar Energy Application, and Physics of Atmosphere and Climate.

2.7 Academic Regulations for the Program

2.7.1 Minimum admission requirements

a) Bachelor's degree Second class upper division with a major in Physics;

b) Second class lower division in areas mentioned in (a) above with 2 years relevant industrial experience;

c) Applicants with Bachelor of Education (Science) qualifications may be considered provided relevant units were covered at undergraduate level.