MAASAI MARA UNIVERSITY

SCHOOL OF SCIENCE

DEPARTMENT OF MATHEMATICS AND PHYSICAL SCIENCE

DOCUMENT**: Master of Science in Physics Syllabus**	
TITLE: : Master of Science in Physics	**EFFECTIVE DATE:** SEPTEMBER, 2023
PREPARED BY **Department of Mathematics and Physical Sciences** **COD----------** **Dean School of Science----------**	APPROVED BY:_____ **DVC(ARSA)** _____ **VICE CHANCELLOR** **CHAIR OF SENATE**

1.0 GENERAL INFORMATION

1.1 Vision and Mission of the University

University Vision

To be a world class University committed to academic excellence for development.

University Mission

To provide Quality University education through innovative teaching, research and consultancy services for development.

1.2 Philosophy of the Institution

The University is guided by a philosophical statement, "*eng'eno e puuan*", which is a Maasai name for "*knowledge is prosperity*". As the University seeks creation of knowledge for prosperity through research, innovation and technology, it is further guided by its core values of **excellence**, **professionalism**, **teamwork**, **creativity & innovativeness**, **transparency & accountability**, **equity** and **social justice.** The University's Philosophy Statements and Mission are complementary, focused on ensuring a genuine need for quality and relevant curricula for promotion of higher education, training, research and innovation. While the Mission Statement focuses on why the University exists, the Philosophy Statement addresses how Maasai Mara University fulfils its educational, research, **innovativeness** and technological mission as an institution for higher learning.

Maasai Mara University offers challenging undergraduate, graduate and professional career programmes that prepare students to remain relevant in the society upon graduation as they prepare to enter the job market to start nurturing their careers. Many students have found Maasai Mara University academic programmes a stepping-stone to further education within their fields of specialization. This has become possible due to a collegial union of academic Schools and Departments, students, staff, administration and business community members who are holistically committed to providing academic programmes, resources, activities and instructional facilities that support excellence in higher education, training, research and innovation. As the University believes and affirms that members of business and industry communities must also share responsibility for developing, establishing, implementing and evaluating educational and any academic programmes for the sake of continued relevance, attractiveness and competitiveness in the society. While primarily concerned with students' intellectual growth and development, the University also supports their physical, moral and spiritual growth and development, and augments their capacity for leadership through co-curricular programmes and the entire students' leadership fraternity.

At the heart of the mission, vision and goals of academic, research, innovation and students' affairs, is the University's fundamental commitment to a strong general education, training, research and innovative programmes that prepare students for global competitiveness, broadening their knowledge in the arts and sciences, helping them integrate learning and community concerns, and preparing them for success in their major fields of study and life after graduation. In all these academic programmes of study, the University encourages the examination of fundamental questions of human concern, respectful dialogue in the context of diverse points of view and experience, as well as the search for truth and social justice for all.

In an atmosphere of intellectual dogmatism made possible by academic freedom, the University builds up and trains students in courses within their areas of advanced study, extend research and innovation in their fields of specialization, produce highly scientific, innovative, technological, scholarly and creative work, and serve the University as well as the nation and the entire global community.

The University identifies and supports students of diverse talents, experiences, knowledge, interests and cultures who are willing and prepared to learn and to seek excellence in themselves and others. The University believes that career education instruction that a student undertake is an art as well as a science. And that the process of undertaking it is indeed very dynamic and helps develops both the skill and the intellect of career-minded individuals in its community. The University further believes that career education is an interactive process on which the future of society depends as emerging graduates become professionals of all types and critically become the drivers for future socio-economic growth and development in the society.

Vital to the success process of supporting excellence in higher education, training, research and innovation are the dedicated members of variously skilled academic support services and the administrative leadership charged with nurturing strategic planning, institutional assessment, and effective and efficient stewardship and strategic deployment of University resources. This connection and collaboration ensures that the University is offering an education that produces an employable, skilled, responsible and accountable person in the society. The enduring fellowship of alumni, sponsors, trustees, and other friends and contributors in the community at large demonstrates their continuing faith and trust in the central mission, vision and goal of Maasai Mara University through various acts of giving, prayer and support.

Infusing this community of shared concern are the distinctive qualities and values of Maasai Mara University, including the belief that faith and reason can interact in mutually fruitful

and favourable ways. Therefore, the University membership encourages a full search for truth, including religious truth, while respecting freedom of personal expression. It also promotes a vigorous and compassionate dialogue among the various faith traditions, and between them and the academic disciplines. At its foundation, teaching, research and innovation at Maasai Mara University are premised upon and committed to the fundamental dignity and unique worth of each human person present.

Finally, as outlined in Kenyan constitution, it is also the philosophy of Maasai Mara University that no person shall be denied admission to any academic programme of any kinds in the University, be excluded from any training whatsoever, be denied the benefits of training, learning and conducting research of any level, or be subjected to discrimination in any recruitment practices or activity of the University because of race, creed, colour, handicap, national origin, sex, age, political affiliation, sexual orientation, marital status or religious belief.

1.3 University Admission Requirements

1.3. 1Minimum University Entrance

i. C+ for Kenya Certificate of Secondary Education (KCSE) holders

1.3.2 Other admission requirements

i. 5 Credit for International General Certificate of Secondary Education (IGCSE) holders.
ii. Minimum of 24 out of 45 points for international Baccalaureate (IB) holders.
iii. Two (2) principal passes for "A" Levels qualifications holders.
iv. C in KCSE for recognized pre-University qualification holders or recognized diploma holders with minimum of credit C (2.50 on a scale of 4.00) from a recognized institution.
v. Any other equivalence as determined by the Kenya National Examination Council

1.3.3 Procedure of application for admission to the University

Step 1: Application for admission should be made on **Official Application Forms** which can be downloaded at http://www.mmarau.ac.ke/admissions/admission-procedure **OR** you can apply directly **ONLINE** by clicking the link Undergraduate (https://docs.google.com/a/mmarau.ac.ke/forms/d/e/1FAIpQLSe0GGZeddkU9XazG16MzrciSKDImUbRBkkw5a6G8mknJi-sOA/viewform?c=0&w=1) / **OR** you can obtain the forms from any of the following offices:

A. Admissions Office

Maasai Mara University, Main Campus
P.O. Box 861- 20500
NAROK
Tel: 020-8082410/**1**

B. Nairobi Satellite Campus

Located at the Kenya Education Management

Institute, Parklands
Tel: 041 2002344

Step 2: Duly completed application forms should be returned to any of the offices indicated above, accompanied with a non-refundable fee of Ksh. 1,000/=. Payment can be made through bankers cheque or paid directly to any of the following University accounts:

- Co-operative Bank, Narok Branch A/C No. 01129337192600
- Equity Bank, Narok Branch A/c No. 0360292999764

1.4 Academic Resources

1.4.1 Facilities and Equipment

a) Lecture Rooms

Available Sitting Spaces in Lecture Rooms in MMU

Sno	Room	Sitting space		Sno	Room	Sitting space	Comment
1.	C 001	50		2.	LT 011	30	
3.	C 002	50		4.	LT 012	30	
5.	C 003	50		6.	LT 013B	130	
7.	C 004	50		8.	LT 014	30	
9.	C 005	50		10.	LT 015	30	
11.	C 006	50		12.	LT 016B	130	
13.	C 007	50		14.	LT 017	30	
15.	C 008	50		16.	LT 018	30	
17.	C 009	50		18.	LT 019B	130	
19.	C 010	50		20.	LT 020	30	
21.	C 011	50		22.	LT 101	300	
23.	C 012	50		24.	LT 103	30	
25.	C 013	50		26.	LT 104B	130	
27.	C 014	50		28.	LT 105	30	
29.	C 015	50		30.	LT 106	30	
31.	C 016	50		32.	LT 107B	80	
33.	C 017	50		34.	LT 108	30	
35.	C 018	50		36.	LT 109	30	
37.	C 019	50		38.	LT 110B	130	
39.	C 020	50		40.	LT 111	30	
41.	B 005	50		42.	LT 112	30	
43.	B 006	50		44.	LT 113B	130	

45.	B 103	50		46.	LT 114	30	
47.	B 104	50		48.	LT 115	30	
49.	LT 001	30		50.	LT 116B	130	
51.	LT 002	30		52.	LT 201	850	
53.	LT 003	30		54.	MH	700	
55.	LT 004	30		56.	Phy Lab	40	
57.	LT 005	30		58.	CheLab	40	
59.	LT 006B	130		60.	ZooLAb	40	
61.	LT 007	30		62.	CompLab	40	
63.	LT 008	30		64.	JournLab	40	
65.	LT 009B	130		66.	HosLab	40	
67.	LT 010	30		68.	GISLab	40	
69.				70.			
		1700			62	3600	

SUMMARY			*SUMMARY*	
TOTAL LECTURE ROOMS	62		Programs	282
TOTAL SITTING SPACES	5450		Lecturers	297
AVAILABLE CHAIRS	4470		Units	979
DEFICIT CHAIRS	980		Rooms	62
TOTAL NO STUD IN SESSION				

b) Library

a. Library mandate

The library is an academic hub for teaching, learning, research and community service to students, staff and other members of the university community.

b. Library facilities

Maasai Mara University library supports teaching, learning and research by providing adequate information materials and conducive reading environment with current reading carrels and workstations. It promotes and provides quality services to support the university programmes in pursuit of scholarly excellence. For research, the library users access more than 34,000 print information sources as well over 10,000 titles electronic journals, databases, catalogues, dictionaries and e-books. It has latest desktop computers for research and access to electronic information resources provided for through fiber optic connectivity.

c. Library policy

The library policy emphasizes on current, relevant acquisition of information materials and use ICT to deliver information to library users.

d. Library staff

The library staff members are trained information professionals and para-professionals with library skills

c) Information communication and Technology

		Quantity	**Capacity**	**Usage**
Software	Matlab	60	60	Shared
	MS Office 2016	60	60	Shared
	Windows 10	60	60	Shared
	Adobe Acrobat Professional	60	60	Shared
	Adobe Design and Web Premium CS6	60	60	Shared
	Adobe Reader	60	60	Shared
	Java Runtime Env 32bit (Oracle) Java Runtime Env	60	60	Shared

	64bit			
	Java Development Kit	60	60	Shared
	Packet Tracer*	60	60	Shared
	SPSS*	60	60	Shared
	Python*	60	60	Shared
	Microsoft Visual Studio	60	60	Shared
	Microsoft SQL Server	60	60	Shared
	Oracle 12c database	60	60	Shared
	Corel Draw	60	60	Shared
Computer	Desktops	60	60	Shared
	Laptops	10	10	Shared
Audio Visual Aid	Projectors	10	10	Shared
Internet	Access Point	8	500 (conOLD access)	Shared

d) Laboratories

I) Physics Lab

Item	**Description**
Facility	• 1 Laboratory with a maximum Capacity of 50 Students Per session • Operation Room
Staff	• 1 Technician
Major Equipment	• 1 Hydraulic press • 1 Mixture • 3 Cathode ray oscilloscopes • 3 Spectrometer • 1 Deep Freezer
Usage	Shared by other programmes

II) Chemistry Lab

Item	Description
Facilities	• 1 Laboratory of a maximum of 50 students per session. • 1 Preparatory room.
Major Equipment	• IR affinity 1s-FTIR • Automatic absorption Spectrophotometer (AAS). • Gas Chromatogram (GC2014)
Other Equipment	• Conductivity meter • Dissolved oxygen meter • PH meter • Analytical balance • Electronic balance • Fridge • Oven/incubator • Pressure gauges • Hot plates • Separating funnels • Refluxing apparatus • Triple filter UV water purifier • Water distiller
Technicians	• 2 Technicians
Usage	Shared by other programmes

III) Biology Lab

The Biology laboratory presents opportunity for educational research practical and experiments to connect theory being taught in classroom setup to hands on praxis. This is achieved by laboratory test trials and experimental proof of concepts. The laboratories are envisaged with conducive teaching and learning space, adequate science laboratory materials and chemicals to enhance teaching and learning intercourse. The lab can holds 35 students per session. The table below indicates the equipment found in the Biology Laboratory The laboratory has two Technicians to guide the students

	EQUIPMENT	**QUANTITY**
1	Centrifuge	2
2	Electric balance	2
3	Autoclave	2
4	Hot plate with stirrer	1
5	Incubator	2

6	Refrigerator	1
7	Compound light microscopes	10
8	Dissecting microscopes	1

IV) Hotel and Hospitality industry

Item	**Description**
Facilities	• 1 Restaurant • Kitchen
Capacity	• A maximum of 8students per session
Major Equipment	• 1Refrigerator • 1Microwave • 1Food Mixer • 1Chest type freezer • 1Deep fat fryer • 3Gas banners + Oven • 3Electronic Oven + Oven • 1Commercial food blender
Small Equipment (Utensils)	• 168 Utensils
Restaurant Equipment	• 144Equipments
House Keeping Equipment	• 4Beds (4X6) • 4Matresses (4X6X6) • 4Bed Covers • 8Blankets • 8Bedsheets • 1Vacuum Cleaner
Staff	• 2 technicians
Usage	Not shared

V) Media Lab

Item	**Description**
Capacity	10 students per session
Equipment	• 5 different microphones • 1 Consumer Camcorder • 2Audio recorders • 1Audio Mixer

	• 1Editing Computer • 1Tripod stand • 1Reflector • 2Still cameras
Technicians	None
Usage	

e) Workshops/Studios

None

f) Tuition farms/Fields

Botanical garden

1.4.2 **References Materials**

a) Core-texts in terms of numbers

18,000 texts

b) E-books, e-journals and accessible databases in terms of subscriptions

Annual subscription of Ksh. 47,000 over 10,000 articles and journals from 28 publishers

c) Print journals in terms of subscriptions

One hundred and five (105) print journals

1.4.3 **Academic Staff**

a) Teaching Staff

Maasai Mara University has 164 teaching staff employed by the University council based on competency and merit. The University followed the CUE standards and guidelines ***INST/STD/04*** 2014 on University Human Resources to hire adequate and competent human resources to carry out its mandate in accordance to its human resource policy. The teaching staff are ranked as shown in the table below.

Sn	**Rank**	**Number**
1	Professors	5
2	Associate Professors	8
3	Senior Lecturers	13

4	Assistant Lecturers	51
5	Tutorial Fellows	43
6	Graduate Assistants	28
7	Chief Technicians	13
8	Senior Technicians	3
TOTAL		164

In addition to the above teaching staff employed on full time basis, the university also hires part time academic staff members from time to time as the need arise to complement the full-time teaching staff.

1.5 Programmes offered by the institution

1.5.1 List of all academic programmes offered in the institution

PROGRAMME
1. Bachelor of Science (Mathematics) **NEW**
2. Bachelor of Science (Physics) **NEW**
3. Bachelor of Science (Chemistry) **NEW**
4. Bachelor of Science in Applied Statistics with Computing **NEW**
5. Bachelor of Science (Mathematics) **OLD**
6. Bachelor of Science (Physics) **OLD**
7. Bachelor of Science (Chemistry) **OLD**
8. Bachelor of Science in Applied Statistics with Computing **OLD**
9. Bachelor of Science (Computer Science) **OLD**
10. Bachelor of Science (Information Science) **OLD**
11. Bachelor of Science (Computer Science) **NEW**
12. Bachelor of Science (Information Science) **NEW**
13. Bachelor of Science (Zoology) **OLD**

14. Bachelor of Science (Botany) **OLD**
15. Bachelor of Science (Zoology) **NEW**
16. Bachelor of Science (Botany)**NEW**
17. Bachelor of Science in Agribusiness Management **NEW**
18. Bachelor of Science in Agricultural Economics and Resource Management **NEW**
19. Bachelor of Science in Economics **NEW**
20. Bachelor of Science in Economics and Statistics **NEW**
21. Bachelor of Science in Financial Economics **NEW**
22. Bachelor of Science in Economics **OLD**
23. Bachelor of Science in Entrepreneurship **NEW**
24. Bachelor of Science in Human Resource Management **NEW**
25. Bachelor of Science in Project Planning Management **NEW**
26. Bachelor of Commerce **NEW**
27. Bachelor of Business Management **OLD**
28. Master of Science in human resource Management **OLD**
29. Master of Business Management **OLD**
30. Master of Business Administration **NEW**
31. Doctor of Philosophy in Business Administration **NEW**
32. Bachelor of Communication and Public Relations **OLD**
33. Bachelor of Communication and Journalism **OLD**
34. Bachelor of Communication and Public Relations **NEW**
35. Bachelor of Communication and Journalism **NEW**
36. Bachelor of Arts in Kiswahili and Journalism **NEW**
37. Bachelor of Arts (Language and Communication Studies) **NEW**
38. Bachelor of Arts in Literature, Theatre and Film **NEW**

39. Bachelor of Arts in Kiswahili and Journalism **OLD**
40. Bachelor of Arts (Language and Communication Studies) **OLD**
41. Master of Arts in Linguistics **OLD**
42. Master of Arts in Kiswahili **OLD**
43. Master of Arts in Literature **OLD**
44. Doctor of Philosophy in Linguistics **OLD**
45. Doctor of Philosophy in Literature **OLD**
46. Doctor of Philosophy in Kiswahili **OLD**
47. Bachelor of Arts in Community Development **OLD**
48. Bachelor of Arts in social Work **OLD**
49. Bachelor of Arts in Religion **OLD**
50. Bachelor of Arts in Political Science and Public Administration **OLD**
51. Bachelor of Arts in Criminology and Penology **OLD**
52. Bachelor of Arts in Sociology **OLD**
53. Bachelor of Arts in History **OLD**
54. Bachelor of Arts in Community Development **NEW**
55. Bachelor of Arts in social Work **NEW**
56. Bachelor of Arts in Religion **NEW**
57. Bachelor of Arts in Political **NEW** Science and Public Administration **NEW**
58. Bachelor of Arts in Criminology and Penology **NEW**
59. Bachelor of Arts in Sociology **NEW**
60. Bachelor of Arts in History **NEW**
61. Bachelor of Arts in Philosophy NEW
62. Bachelor of Hotels and Hospitality Management. OLD
63. Bachelor of Tourism Management **OLD**

64. Bachelor of Hotels and Hospitality Management. **NEW**
65. Bachelor of Tourism Management **NEW**
66. Bachelor of Science in Wildlife Management **OLD**
67. Bachelor of Science in Forest Ecosystems Management **OLD**
68. Bachelor of Science in Forest Ecosystems Management **OLD**
69. Bachelor of Science in Wildlife Management **NEW**
70. Bachelor of Science in Parks, Recreation and Leisure Management **NEW**
71. Bachelor of Science in Forest Ecosystems Management **NEW**
72. Bachelor of Environmental Studies (Biology and Health) **OLD**
73. Bachelor of Arts (Geography) **OLD**
74. Bachelor of Environmental Management **OLD**
75. Bachelor of Environmental Studies (Environmental Earth Sciences) **OLD**
76. Bachelor of Environmental Studies (Biology and Health) **NEW**
77. Bachelor of Arts (Geography) **NEW**
78. Bachelor of Environmental Management **NEW**
79. Bachelor of Urban and Regional Planning **NEW**
80. Bachelor of Science in Leather Production and Processing **NEW**
81. Bachelor of Science in Animal Health and Production **NEW**
82. Bachelor of Environmental Studies (Environmental Earth Sciences) **NEW**
83. Master of science in Environmental Studies **CURRENT**
84. Master of Science in Land Resource Management **NEW**
85. Master of Arts in Geography **NEW**
86. Doctor of philosophy in Land Resource Management **NEW**
87. Doctor of Philosophy in Environmental Planning Management **NEW**
88. Doctor of Philosophy in Environmental Studies **OLD**

89. Bachelor of Education Science **(NEW)**
90. Bachelor of Education Arts **(NEW**)
91. Bachelor of Education Science **(OLD)**
92. Bachelor of Education Arts **(OLD)**
93. Bachelor of Education Primary Option**(OLD)**
94. Master of Education (Educational Administration) **OLD**
95. Executive Master of Education (Educational Leadership and policy Studies) **OLD**
96. Master of Education (Curriculum Studies) **OLD**
97. Master of Education (Curriculum, instruction and Educational Media) **OLD**
98. Doctor of Philosophy in Education (Educational administration) **OLD**
99. Doctor of Philosophy in Education (Curriculum Studies) **OLD**
100. Doctor of Philosophy in Education (Curriculum, instruction and Educational Media) **OLD**
101. Bachelor of Education in Early Childhood Education **NEW**
102. Bachelor of Education Science with Special Needs Education **NEW**
103. Bachelor of Education Arts with Special Needs Education **NEW**
104. Bachelor of Education Science with Guidance and Counseling **NEW**
105. Bachelor of Education Arts with Guidance and Counseling **NEW**
106. Bachelor of Education Early Childhood Education **OLD**
107. Bachelor of Education with Guidance and Counseling **OLD**
108. Bachelor of education Special Needs Education **OLD**
109. Bachelor of Education Primary option with Special Needs Education **OLD**
110. Master of Education (History of Education) **OLD**
111. Master of Education (Sociology of Education) **OLD**
112. Master of Education (Guidance and Counseling) **OLD**
113. Master of education (Early Childhood Development) **OLD**

114.	Master of education (Philosophy of Education) **OLD**
115.	Master of Education (Special Needs Education) **OLD**
116.	Master of Education (Educational Psychology) **OLD**
117.	Doctor of Philosophy in Guidance and Counseling **NEW**
118.	Doctor of Philosophy in Early Childhood Development Education **OLD**
119.	Doctor of Philosophy in Educational Psychology **OLD**

1.5.2 Duration of each programme including total lecture/instructional hours

SCHOOL	DEPARTMENT	PROGRAMME	Duration	Total lecture/instructional hours
SCIENCE	**Mathematics and Physical sciences (MPS)**	Bachelor of Science (Mathematics) **NEW**	4years	2314
		Bachelor of Science (Physics) **NEW**	4years	2392
		Bachelor of Science (Chemistry) **NEW**	4years	2301
		Bachelor of Science in Applied Statistics with Computing **NEW**	4years	2262
		Bachelor of Science (Mathematics) **OLD**	4years	2314
		Bachelor of Science (Physics) **OLD**	4years	2392
		Bachelor of Science (Chemistry) **OLD**	4years	2353
		Bachelor of Science in Applied Statistics with Computing **OLD**	4years	2262
	Information Sciences	Bachelor of Science (Computer Science) **OLD**	4years	2184
		Bachelor of Science (Information Science) **OLD**	4years	2496
		Bachelor of Science (Computer	4years	2379

		Science) **NEW**		
		Bachelor of Science (Information Science) **NEW**	4years	2496
		Bachelor of Science (Zoology) **OLD**	4years	2184
		Bachelor of Science (Botany) **OLD**	4years	2184
		Bachelor of Science (Zoology) **NEW**	4years	2184
		Bachelor of Science (Botany)**NEW**	4years	2496
BUSINESS AND ECONOMICS	**Economics**	Bachelor of Science in Agribusiness Management **NEW**	4years	2184
		Bachelor of Science in Agricultural Economics and Resource Management **NEW**	4years	2184
		Bachelor of Science in Economics **NEW**	4years	2184
		Bachelor of Science in Economics and Statistics **NEW**	4years	2184
		Bachelor of Science in Financial Economics **NEW**	4years	2184
		Bachelor of Science in Economics **OLD**	4years	2184
	Business Management	Bachelor of Science in Entrepreneurship **NEW**	4years	2262
		Bachelor of Science in Human Resource Management **NEW**	4years	2444
		Bachelor of Science in Project Planning Management **NEW**	4years	2301
		Bachelor of Commerce **NEW**	4years	2340
		Bachelor of Business Management **OLD**	4years	2340
		Master of Science in human resource Management **OLD**	3years	702

		Master of Business Management **OLD**	3years	702
		Master of Business Administration **NEW**	3years	702
		Doctor of Philosophy in Business Administration **NEW**	2years	702
ARTS AND SOCIAL SCIENCES	**Media Film and Communication**	Bachelor of Communication and Public Relations **OLD**	4years	2184
		Bachelor of Communication and Journalism **OLD**	4years	2184
		Bachelor of Communication and Public Relations **NEW**	4years	2184
		Bachelor of Communication and Journalism **NEW**	4years	2184
	Linguistics, Languages and Culture	Bachelor of Arts in Kiswahili and Journalism **NEW**	4years	2496
		Bachelor of Arts (Language and Communication Studies) **NEW**	4years	2520
		Bachelor of Arts in Literature, Theatre and Film **NEW**	4years	2520
		Bachelor of Arts in Kiswahili and Journalism **OLD**	4years	2496
		Bachelor of Arts (Language and Communication Studies) **OLD**	4years	2520
		Master of Arts in Linguistics	2yeras	1326
		Master of Arts in Kiswahili	2years	1326
		Master of Arts in Literature	2years	1326
		Doctor of Philosophy in Linguistics	3years	1624
		Doctor of Philosophy in Literature	3years	1624
		Doctor of Philosophy in Kiswahili	3years	1624

	Social Studies	Bachelor of Arts in Community Development **OLD**	4years	2184
		Bachelor of Arts in social Work **OLD**	4years	2184
		Bachelor of Arts in Religion **OLD**	4years	2184
		Bachelor of Arts in Political Science and Public Administration **OLD**	4years	2184
		Bachelor of Arts in Criminology and Penology **OLD**	4years	2184
		Bachelor of Arts in Sociology **OLD**	4years	2184
		Bachelor of Arts in History **OLD**	4years	2184
		Bachelor of Arts in Community Development **NEW**	4years	2196
		Bachelor of Arts in social Work **NEW**	4years	2379
		Bachelor of Arts in Religion **NEW**	4years	2379
		Bachelor of Arts in Political **NEW** Science and Public Administration **NEW**	4years	2379
		Bachelor of Arts in Criminology and Penology **NEW**	4years	2340
		Bachelor of Arts in Sociology **NEW**	4years	2301
		Bachelor of Arts in History **NEW**	4years	2470
		Bachelor of Arts in Philosophy NEW	4years	2262
TOURISM AND NATURAL RESOURCE MANAGEMENT	**Tourism and Hospitality Management**	Bachelor of Hotels and Hospitality Management. OLD	4years	2665
		Bachelor of Tourism Management **OLD**	4years	2613
		Bachelor of Hotels and Hospitality Management. **NEW**	4years	2418
		Bachelor of Tourism Management **NEW**	4years	2418

	Forestry and Wildlife Management	Bachelor of Science in Wildlife Management **OLD**	4years	2288
		Bachelor of Science in Forest Ecosystems Management **OLD**	4years	2392
		Bachelor of Science in Forest Ecosystems Management **OLD**	4years	2301
		Bachelor of Science in Wildlife Management **NEW**	4years	2392
		Bachelor of Science in Parks, Recreation and Leisure Management **NEW**	4years	2483
		Bachelor of Science in Forest Ecosystems Management **NEW**	4years	2301
	Environmental Studies, Geography and Agriculture	Bachelor of Environmental Studies (Biology and Health) **OLD**	4years	2301
		Bachelor of Arts (Geography) **OLD**	4years	2315
		Bachelor of Environmental Management **OLD**	4years	2496
		Bachelor of Environmental Studies (Environmental Earth Sciences) **OLD**	4years	2301
		Bachelor of Environmental Studies (Biology and Health) **NEW**	4years	2301
		Bachelor of Arts (Geography) **NEW**	4years	2315
		Bachelor of Environmental Management **NEW**	4years	2496
		Bachelor of Urban and Regional Planning **NEW**	4years	2457
		Bachelor of Science in Leather Production and Processing **NEW**	4years	2470
		Bachelor of Science in Animal Health and Production **NEW**	4years	3150
		Bachelor of Environmental Studies	4years	2301

		(Environmental Earth Sciences) **NEW**		
		Master of science in Environmental Studies **CURRENT**	2yeasrs	754
		Master of Science in Land Resource Management **NEW**	2years	754
		Master of Arts in Geography **NEW**	2years	546
		Doctor of philosophy in Land Resource Management **NEW**	3years	468
		Doctor of Philosophy in Environmental Planning Management **NEW**	3years	468
		Doctor of Philosophy in Environmental Studies **OLD**	3years	962
EDUCATION	**Curriculum Instruction and Educational Management**	Bachelor of Education Science **(NEW)**	4years	2184
		Bachelor of Education Arts **(NEW**)	4years	2223
		Bachelor of Education Science **(OLD)**	4years	2184
		Bachelor of Education Arts **(OLD)**	4years	2184
		Bachelor of Education Primary Option**(OLD)**	4years	2184
		Master of Education (Educational Administration) **OLD**	2years	630
		Executive Master of Education (Educational Leadership and policy Studies) **OLD**	1year	630
		Master of Education (Curriculum Studies) **OLD**	2 years	630
		Master of Education (Curriculum, instruction and Educational Media) **OLD**	2years	630
		Doctor of Philosophy in Education (Educational administration) **OLD**	3years	676

		Doctor of Philosophy in Education (Curriculum Studies) **OLD**	3years	676
		Doctor of Philosophy in Education (Curriculum, instruction and Educational Media) **OLD**	3years	676
	Education Foundations, Psychology/Guidance and Counseling, Special Needs Education & Early Childhood Development Education	Bachelor of Education in Early Childhood Education **NEW**	4years	2262
		Bachelor of Education Science with Special Needs Education **NEW**	4years	3042-3276
		Bachelor of Education Arts with Special Needs Education **NEW**	4years	3042-3120
		Bachelor of Education Science with Guidance and Counseling **NEW**	4years	2808-3042
		Bachelor of Education Arts with Guidance and Counseling **NEW**	4years	3120-3042
		Bachelor of Education Early Childhood Education **OLD**	4years	2262
		Bachelor of Education with Guidance and Counseling **OLD**	4years	2262
		Bachelor of education Special Needs Education **OLD**	4years	2262
		Bachelor of Education Primary option with Special Needs Education **OLD**	4years	2262
		Master of Education (History of Education) **OLD**	2years	630
		Master of Education (Sociology of Education) **OLD**	2years	630
		Master of Education (Guidance and Counseling) **OLD**	2years	630
		Master of education (Early Childhood Development) **OLD**	2years	630
		Master of education (Philosophy of	years	630

		Education) **OLD**		
		Master of Education (Special Needs Education) **OLD**	2years	630
		Master of Education (Educational Psychology) **OLD**	2years	630
		Doctor of Philosophy in Guidance and Counseling **NEW**	3years	676
		Doctor of Philosophy in Early Childhood Development Education **OLD**	3years	676
		Doctor of Philosophy in Educational Psychology **OLD**	3years	676

1.5.2 Definitions of

a) Credit hours

This refers to the total number of hours required to be taught per week which for this program is 4. This translates to 52 credit hours per semester of 13 weeks.

b) Lecture/instructional hours

Means a period of time equivalent to one hour and representing one such instructional hour in lecture form, two in a tutorial or open learning session, three in a laboratory practical or practicum and five in farm or similar practice.

c) Contact Hours

Synonymous with Lecture/instructional hours

d) Course Units

A course unit is a defined curriculum that forms part of an academic programme.

1.5.3 Academic organization of the programmes reflecting academic quarters/ trimester/ Semesters

Maasai Mara University has adopted a semester system where an academic year runs for two semesters each consisting of 13 weeks of teaching and 2 weeks of end of semester exams.

2.0 CURRICULUM

2.1 Title of programme

The Department of Mathematics and Physical Sciences, in accordance with the general objectives of Maasai Mara University (MMU) offers a programme of studies leading to Master of Science in Physics abbreviated MSc (Physics).

2.2 Philosophy of the programme

With the ever-changing needs of the global economy, demands in science also changes. For any technology to succeed, trained personnel is needed to sustain it through academic rigor, partnership with the industry and research institutions. The MSc in Physics programme is designed to respond to the dynamic demands of the world.

2.3 Rationale of the programme

Postgraduate degree Programs normally form an integral part of a University, to serve the general purpose of developing research capabilities through dedicated and persistent scholarship as well as providing relevant trained manpower needed for teaching at institutions of higher learning and/or carrying out research in Academic, public and private institutions.

The program includes a set of common core courses in physics in the first semester which are compulsory. Individually courses and a tailored lab component and are offered in the second semester in the area of specialization. The research work runs right from the time of entry of the student until successful submission of thesis under the guidance of area specialists. The MSc in physics research will be offered in the following areas of specialization;

i. Material Science
ii. Electronics
iii. Renewable energy

2.3.1 Needs assessment/ market survey/ situation analysis

Science, technology and innovation has been identified as a central pillar for Kenya's development and a foundation for vision 2030. To drive the attainment of vision 2030, high-level scientists and technologists would need to be trained. Accordingly Physics as a fundamental science is crucial to the achievement of the dream. Currently, the technology industry in Kenya grows at annual rate of 20% however, growth in human capital in the same industry is low. Therefore, there is need to invest in human capital to match the industry growth rate.

The programme is designed to satisfy the needs and aspirations of the society from where its students are drawn. The programme is sufficiently flexible to permit and encourage students to develop interest in various fields and specialized options. The options are specifically tailored towards industrial applications and the overall pattern of employment requirements of physics in the job market.

2.3.2 Stakeholders involvement

The Commission for University Education estimates that for Kenya to meet her higher education knowledge needs, there is need for production of 1000 PhDs per year. The route to PhD is a Masters degree. To contribute to this national need, the former students who excelled in Physics (1^{st} class honours) are to be retained and trained in the department. Also personal research by members of the department, report that the portfolio of the department and the university will remain at all time without the research component which is well accomplished only with graduate programmes. The MSc (Physics) curriculum has therefore been designed in such a way

that the product will have relevant market skills in the three specialization areas in addition to the general physics knowledge acquired in the course of study

2.3.3 Justification of the programme

High-level skilled manpower is essential for strong, sustainable and balanced growth. The number of people at work and how productive they are depends on available opportunities to acquire and maintain certain skills. The MSc. (Physics) programme offers specialized training opportunities to industry and the academia to help maintain the desired balance in economic development.

2.4 Goals of the Programme

The program aims to train advanced personnel competent in either Electronics, Material Science and Renewable energy, who are well equipped to meet the challenges in industry. This would be possible since the programme will enable students to:

i. Develop professional competence in carrying out laboratory research and be proficient in critical analysis of important scientific articles;
ii. Develop general competence in Physics and in-depth knowledge in their chosen area;
iii. Plan, execute, report, and defend an original piece of research relevant to their study.
iv. Extend and redefine existing knowledge in physics.
v. Demonstrate good mastery of physics
vi. Display originality and creativity in the application of knowledge, skills and practice in the field of physics
vii. Contribute to advanced knowledge and skills in the field of physics
viii. Demonstrate a substantial authority, innovativeness, autonomy, scholarly and professional integrity and with sustained commitment to the development of new ideas or processes at the forefront of the discipline or field of physics

2.5 Expected learning outcomes of the programme

2.5.1 The expected learning outcomes of the programme

a) Knowledge and understanding

The physics programme enables students develop competencies required to:

i) Solve problems in Physics and offer relevant solutions using appropriate mathematical tools.
ii) Understand physical phenomena and model their behaviour through analytical and/or mathematical techniques.
iii) Apply principles of operation of physical devices and instruments
iv) Know the environmental and social impact of a Physicist's activities

b) Cognitive skills/Application of knowledge

The physics graduate should be able to:

i) Execute and critically analyze results of an investigation and make logical conclusions.
ii) Use scientific principles in solutions of physical problems.
iii) Formulate research proposals, conduct the research, analyze data obtained from the research and report accurately in various branches of physical processes.
iv) Use computers in the manipulation of physics problems

2.5.2 The expected learning outcomes of the specialization areas

i) Understand business and management techniques relevant to a Physicist
ii) Execute and critically analyze results of an investigation and make logical conclusions.
iii) Formulate research proposals, conduct the research, analyze data obtained from the research and report accurately in various branches of physical processes.
iv) Publish the work in refereed journal
v) Write and defend the thesis of their work

2.6 Mode of Delivery and Duration of the programme

2.6.1 Mode of Delivery

Coursework will be delivered through lectures. Other modes may include; simulations, group discussions, practicals, report writing and assignment.

The student under supervision of senior faculty will undertake research in the chosen area of specialization

2.6.1 Duration of the programme

The MSc (Physics) programme is by research and course work.

The MSc (Physics) programme will take a minimum of 2 academic years of 2 semesters each for full time students and a minimum of 3 years part-time students.

2.7 Academic regulations

2.7.1 Admission requirements

Common regulations for admission to the Master of Science degree at Maasai Mara University and the School of Science and Information Sciences shall apply. Specifically:

i. Holders of a Bachelor's degree with at least Second Class Honours (Upper Division) in Physics or a related subject from Maasai Mara University or any other Institution recognized by the University Senate qualify for admission.
ii. Holders of a Bachelors degree with a Second Class Honours (Lower Division) in Physics or a related subject from Maasai Mara University or any other Institution recognized by the University Senate, plus at least two years relevant research/work experience may be considered for admission.

iii. Holders of a Bachelors Pass degree in Physics or a related subject from Maasai Mara University or any other Institution recognized by the University Senate, plus at least five years relevant research/work experience may be considered for admission.

2.7.2 Regulation for Credit Transfer

In line with the existing qualification frameworks,

i. Credit transfers shall only be accepted from accredited institutions and programmes;
ii. Credit transfers may be permitted up to a maximum of 49% of the core course Credit Hours for similar programme in Physics at the same level.

2.7.3 Course Requirements

Students are expected to:

i. Attend at least 80 % of the scheduled lessons/Sessions/Seminars in the programme to be allowed to take examinations.
ii. Register attendance for every lessons/Sessions/Seminars taken.
iii. Give at least two presentations in seminars and workshop in their research work before they graduate. In addition the student must present at university conference
iv. Publish one paper in a refereed journal.
v. Meet all course requirements such as meeting the supervisors on bi-weekly basis.

2.7.4 Student Assessment policy/Criteria

The General Postgraduate University Examination Regulations and the special examination shall apply. End of semester exams are written within a 3-hour duration.

i. Pass mark: In all the courses the pass mark is 50% of the total score.
ii. Submission and examination of thesis: This is done according to the common regulations of the board of postgraduate Studies, for the Masters degree at the University.
iii. Where the Common University regulations are silent, Senate shall normally provide guidance.
iv. The assessment of candidates shall include:

(a) Theory Courses

Continuous assessment tests (at least two CATs)	30%
End of semester exam; A written paper of 2 hours duration	70%
Total	100%

(b) Advanced laboratory techniques course

Proposal	20%
Written report	70%
Oral defense	10%
Total	100%

(c) Thesis

Written work	80%
Oral defense	20%
Total	100%

2.7.5 Grading system

The grading system to be adopted for the programme will be as follows:

Mark %	Grade	Remark
70 – 100	A	Pass
60 - 69	B	Pass
50 – 59	C	Pass
49 and Below	D	Fail

2.7.6 Examination Regulations

2.7.6.1 General Rules

(i) University Examinations shall take precedence over external or any other examinations

(ii) A candidate who has missed 20% or more of the required course attendance in a given course shall not be allowed to sit for University Examinations and shall be required to retake the course

(iii) University Examinations shall normally be conducted from Monday to Friday, and on any other day approved by Senate.

(iv) Candidates who may not sit University Examinations on scheduled dates on grounds approved by senate, shall seek permission immediately the examination timetable is released by filling examination deferment forms signed by the following officers; chair of relevant department and Dean of the School. A copy of the form shall be submitted to the office of the Registrar Academic Affairs.

(v) All courses shall be examined within the semester in which they are taken, unless otherwise approved by Senate.

(vi) All Schools shall be required to define in their curricula: core, required, pre-requisite and elective courses as approved by Senate. These should be strictly followed in administration of examinations.

(vii) A candidate who fails to turn up for an examination shall be deemed to have failed that examination and shall be required to RESIT or RETAKE the said examinations when next offered subject to applicable clauses 5.1 or 5.2 respectively.

(viii) Marks for Industrial Attachment shall be submitted within two weeks from the end of attachment period.

(ix) A student who misses industrial attachment will take it when next offered unless by prior permission of senate

2.7.6.2 Examination irregularities are classified as follows:

Group1

(i) Being found in the examination room in possession of the prohibited items stated in section 16(6) of this document

(ii) Committing a breach of any other examination rule or regulation which may be communicated to the candidate from time to time by the invigilators.

Group II

(i) Having unauthorized material in an examination room written on paper or other materials.

(ii) Having unauthorized material in an examination room in electronic device such as mini computers, calculators and cellphones.

(iii) Reading or attempting to read answer scripts belonging to another candidate.

(iv) Possessing an unwritten examination script, other than the one issued officially by an invigilator in the examination room.

Group III

(i) Copying from, or attempting to copy from, or making references to unauthorized material(s)in the examination room.

(ii) Permitting another candidate to copy from or make use of one's papers to answer questions.

(iii) Copying from the examination papers of another candidate.

Group IV

(i) Carrying examination script/answer sheets, one's/or another candidate's out of the examination room.

(ii) Obtaining or attempting to obtain assistance from another candidate, and/or giving or attempting to give assistance to another candidate (impersonation), directly in answering an examination paper. If the imposter is not a student of Maasai Mara University, the University shall be at liberty to file a criminal charge of impersonation in a court of law against the person.

(iii) Possessing a written or unwritten examination script, other than the one issued officially by an invigilator in the examination room.

(iv) Destroying evidence which may be used as proof of an examination irregularity.

(v) Threatening invigilators, and obstructing the invigilator from carrying out his/her duties and assaulting the invigilator or causing him or her actual bodily harm.

(vi) Sitting for examinations at a time when one is on suspension or has been expelled to show cause.

(vii) Committing a subsequent irregularity after being warned or suspended and re-admitted.

(viii) Failing to appear before the Standing Committee on Examination Irregularities when one has been summoned to do so after a suspected examination irregularity. In this case, the candidate shall be expelled to show cause.

(ix) Any evidence of cheating in an examination that may be detected during marking.

Group V

(i) Forging an examination card and using it to sit an examination or sitting an examination when not authorized.
(ii) Accessing a question paper or questions of an examination before the date and time scheduled for the examination.
(iii) Presenting for marking an examination answer script whose answers were written elsewhere other than in the examination venue at the time when the particular examination paper was scheduled to be done.

Group VI

Any emerging evidence of cheating, falsification of examination results, or committing any of the offences in group I-V above after the student has graduated.

2.7.6.3 Disciplinary Action

If it is evidently established that a candidate has committed an examination irregularity, disciplinary action shall be taken immediately. Although an attempt has been made to match an examination irregularity with a disciplinary action(s) by making them fall in the same group, disciplinary action may include either one or a combination of the following:

Group I

Either of the following verdicts shall apply:

(i) Issuance of a stern warning letter to the candidate
(ii) Cancellation of examination results in the affected course and issuance of a stern warning letter

Group II

Cancellation of the examination results for the course and suspension of the candidate for one (1) academic year.

Group III

Cancellation of the examination results for the course and suspension of the candidate for a period of two (2) academic years

Group IV

(i) Cancellation of all examination results and expulsion of the candidate from the University.

OR

(ii) Cancellation of all examination results for the academic year and suspension of the candidate from the University for three (3) academic years

Group V

Refer the case to student disciplinary committee

Group VI

Withdrawal or cancellation of the degree/diploma/certificate conferred on or awarded to the candidate upon establishing that cheating or falsification of results did indeed occur.

i. There shall be a Standing Examination Irregularities Appeals Board appointed by Senate to hear examination irregularity appeal cases whose membership shall be as follows:
    - Chairperson - Chairperson of Senate or Nominee
    - Members - 3 members of Senate
    - Dean of the School
    - Dean of Students
    - The Registrar Academic Affairs as Secretary
    - Legal Officer shall be in attendance.

ii. Any appeal shall be made in writing within fourteen (14) days of the decision of the Standing Committee on Examination Irregularities to the Chairperson of Senate who shall then cause a meeting of the Committee to be convened within fourteen (14) days after receiving such a request. The Registrar, Academic Affairs shall invite the student who has appealed to appear before the Standing Committee on Examination Irregularities

iii. The Standing Examination Irregularities Appeals Board shall only consider the grounds of appeal presented by the student. There shall be no fresh hearing or presentation of new evidence during the hearing of the appeal

iv. The standing Examination Irregularities Appeals Board may make any of the following decisions: confirm the earlier decision of the Standing Committee, amend, vary or arrive at a new ruling on the case.

v. The Standing Examination Irregularities Appeals Board shall report its findings to Senate for consideration within one month of hearing the appeal and the outcome communicated to the student by the Registrar, Academic Affairs within five (5) working days after Senate consideration.

vi. No other appeal shall be entertained after Senate has considered the report of the Standing Examination Irregularities Appeals Board and pronounced its verdict.

2.7.7 Moderation of Examinations

Course work examination and consequently the results shall be moderated through a process of which includes

- Internal Moderation
- External Moderation

In order to monitor the reliability and validity of assessment procedures and academic standards, both internal and external examiners shall be involved in the moderation of examinations as specified in the University Examination Regulations:

(i) Setting and internal moderation of Examinations shall be carried out at the Department

(ii) External Examiners shall moderate questions papers. External Examiners' comments, if any shall be incorporated in the question paper by individual lecturers coordinated by examination officer and supervised by Chairperson of Department.

(iii) The departmental examinations officer through the Chairperson of Department, (Principal Internal Examiner), shall submit the moderated papers to designated University Examination Centre for further processing and safe custody.
(iv) The Dean of School, being Chief Internal Examiner, shall ensure that the above process is strictly adhered to.
(v) Members of staff who are Maasai Mara University students are prohibited from handling examinations relevant to their programme of study.
(vi) All copies of draft examination papers marked for disposal must be destroyed by shredding.

2.7.8 Graduation Requirements

a. To graduate a candidates must:
   i. Pass all the examinations or resit examinations (A student is allowed to resit examinations if he/she fails a maximum of two theory courses offered for this degree programme).
   ii. Successfully defend their thesis before a validly constituted faculty board.

b. Graduation is upon the approval of Senate.

2.7.9 Classification of Degrees

This degree is not classified.

2.8 Course Evaluation/ Evaluation of Academic staff

Course evaluation shall normally be done for every course by the consumers (students), providers (lecturers), and peers (both internal and external) using the approved course evaluation tool. The evaluation feedback shall be implemented to enhance quality.

Staff performance: To be based on student evaluations, evaluation by head of department and self-evaluation.

2.9 Management and administration of the programme

For effective and seamless flow, the programme will be managed by a postgraduate coordinator who will ensure that lecturers perform their teaching duties effectively. The coordinator will ensure that the students are continuing with the programme registered for. The coordinator is the first call for graduate students, will handle supervisor-student conflicts if any. The coordinator will ensure that the candidate's thesis is ready for examination. The coordinator will report directly to the chairman of the department of Mathematics and Physical Sciences.

2.10 Courses offered for the programme

The course codes consist of two parts: PHY followed by space and 4 digits. PHY stands for "Physics" and means it is a Physics course. The first digit indicates the level of the course. The second digit indicates the semester the course is offered. The third two digits is the course's

serialization. For example, PHY 8102 means that the course is a Masters course offered in the first semester with a serial '02'. University-wide common courses are *italicized*.

Programme core courses and required courses are in normal font.

Elective courses are in bold font.

The following definitions for a unit and credit hours apply:

1 unit ≡ 4 lecture hours per week per semester.

1 credit hour ≡ 1 lecture hour per week per semester.

2.10.1 Distribution Table

YEAR	UNIVERSITY COMMON COURSES (UNITS)	SCHOOL COMMON COURSES	SPECIALIZATION (DEPT/DISCIPLINE) (UNITS)	ELECTIVES (UNITS)	TOTAL CREDIT HOURS
ONE	0	0	6	3	36
ONE & TWO	0	0	1	0	12
TOTAL	0	0	7	3	48

2.10.2 Programme learning outcomes

Learning outcomes	Year 1		Year 2	
	Courses	Credit hrs	Courses	Credit hrs
Programme learning outcomes				
Solve problems in Physics and offer relevant solutions using appropriate mathematical tools.	PHY 8102 PHY 8104	4	PHY 8000	12
Understand physical phenomena and model their behaviour through analytical and/or mathematical techniques.	PHY 8102 PHY 8207 PHY 8209 PHY 8209	4 4 4 4	PHY 8000	12
Apply principles of operation of physical devices and instruments	PHY 8210 PHY 8215	4 4	PHY 8000	12
Know the environmental and social impact of a Physicist's activities	PHY 8210 PHY 8209 PHY 8214	4 4 4	PHY 8000	12
Use scientific principles in solutions of physical problems.	PHY 8102 PHY 8207	4 4	PHY 8000	12
Use computers in the manipulation of physics problems.	PHY 8102 PHY 8207 PHY 8208 PHY 8209	4 4 4 4	PHY 8000	12
Specialization learning outcomes				
Understand business and management techniques relevant to a Physicist	PHY 8207	4	PHY 8000	12
Execute and critically analyze results of an investigation and make logical conclusions.	PHY 8207	4	PHY 8000	12
Formulate research proposals, conduct the research, analyze data obtained from the research and report accurately in various branches of physical processes.	PHY 8207	4	PHY 8000	12

2.10.3 Course Structure

Year 1- Year 2

Course Code	Course Title	Credit Hours
PHY 8000	Research and Thesis	12

Year one Semester 1 Core Courses

Course Code	Course Title	Credit Hours
PHY 8102	Mathematical techniques in physics	4
PHY 8103	Classical mechanics	4
PHY 8104	Electrodynamics	4
PHY 8105	Quantum mechanics	4
PHY 8106	Statistical mechanics	4
	Total	20

Year one Semester 2: Electronics Courses

Course Code	Course Title	Credit Hours
PHY 8207	Advanced laboratory techniques	4
PHY 8208	Digital Electronics	4
PHY 8209	Semiconductor physics and devices	4
PHY 8210	Integrated electronics	4
	Total	16

Year one Semester 2: Material Science Courses

Course Code	Course Title	Credit Hours
PHY 8207	Advanced laboratory techniques	4
PHY 8211	Solid state physics	4
PHY 8212	Energy Bands, Magnetism and Amorphous Materials	4
PHY 8213	Thermal Behaviour of materials	4
	Total	16

Year one Semester 2: Renewable Energy Courses

Course Code	Course Title	Credit Hours
PHY 8207	Advanced laboratory techniques	4
PHY 8214	Electrical, Magnetic and Optical Properties of Solids	4
PHY 8209	Semiconductor physics and devices	4
PHY 8215	Renewable energy technologies	4
	Total	16

2.10.4 Total credit hours and course units required for graduation

To graduate, a student will be required to have done 48 credit hours which is within the range of 40-58 as stipulated by Commission on University Education Curriculum Standards.

3.0 Course Description

PHY 8000 **12 Credit hours**

Thesis Description

A candidate identifies a research topic and develops a concept paper; the student is allocated a supervisors or two from among the academic members of staff to mentor the student as he/ she develops a research proposal. The candidate presents the proposal at a departmental seminar where the audience critiques the research proposal and makes appropriate recommendations for changes to improve it. The student submits the proposal to the Board of Postgraduate Studies through the physics postgraduate coordinator in liaison with the Dean of School, for approval. The student conducts the research according to the proposal and under the supervision of the supervisor(s). The student then analyses the results, writes a thesis which ones approved by the supervisor(s), postgraduate coordinator and dean of the school, the thesis is sent to three examiners (two internal and one external). Once the results from the examination are known the candidate will be invited for an oral defense of their own work in a departmental seminar.

PHY 8102: MATHEMATICAL TECHNIQUES IN PHYSICS 4 Credit hours

Purpose

Mathematical techniques in physics is about the development of mathematical methods for application to problems in physics and related fields. It is more on the application of mathematics to problems in physics and the development of mathematical methods suitable for such applications and for the formulation of physical theories.

Course Objectives:

Upon successful completion of this course students will be able:

i. To apply mathematical methods in solving problems in physics.
ii. To develop mathematical methods suitable for physical applications and for the formulation of physical theories.

Course Content:

Green functions, Beta, gamma and error functions. Complex integrations - method of residues, Tensor algebra - properties of tensors - tensorial characteristics of physical quantities, Theory of linear vector spaces, Properties of linear operators, Emphasizing applications in solving physical problems and giving examples from Physics and engineering.

Course Methodology:

Mode of delivery is as given in section 3.4. Students will experience a qualitative and quantitative development of topics using principles of physics and tools of mathematics. Other learning activities are as follows:

Interactive lectures that may include, Group discussions by students at their private times as compelled by a series of assignments. In doing assignments, students will apply these theories and models to concrete physical problems.
Development of physical theory using tools of mathematics. In doing assignments, students use these tools to solve problems
Students may present neatly written, well researched and nicely argued reports on certain research based problems.
Students are expected to work on the “end of chapter" problems as one of the best ways to develop analytic and synthetic thinking skills
Students are also expected to do outside reading, beyond the circulated lecture notes to acquire and ingrain good mastery of the course content.

Instructional Materials/Equipment:
Lectures should ideally be delivered using projectors to enable adequate illustration of concepts.

Course Assessment
Students are evaluated on their understanding, as demonstrated by their competence in using the knowledge gained in this course in line with Section 2.5.4iv(a) on evaluation.

Core reading material for the course
1. Mathematical Methods for Physics and Engineering by K.F. Riley and M.P. Hobson
2. Mathematical Methods for Physicists: A concise introduction, Tai L. Chow, 2000

Recommended reference materials
1. Mathematical Methods of Physics by Matthews and Walker
2. Mathematical tools for Physics
3. Mathematical Principles of Theoretical Physics Tian and Shouhong Wang, 2015

PHY 8103: CLASSICAL MECHANICS 4 Credit hours

Purpose
The aim of this course is to develop the student with an understanding of mechanics of particles and a system of particles. Further the learner will be able to use various principles to develop equations of motion for a particular particle.

Learning outcomes
By the end of this course the student should be able to:
i) define and describe mechanics of particles
ii) describe the mechanics of a system of particles
iii) describe D’Alembert’s Principle and derive Lagrange’s equation of motion
iv) distinguish between variation principles and Hamilton’s principle
v) Apply Lagrange’s and Hamilton’s equations to physical problems

Course content
Mechanics of particle, moving co-ordinate systems; mechanics of a system of particles; The Lagrangian formulation; Hamilton equation for Hamilton's characteristic function, separation of variables and applications to particle motion under central force. Variational principles; The two body central force problems; Canonical transformation; Hamilton-Jacobi methods of canonical perturbation theory; Small Oscillations; Special relativity in classical mechanics

Mode of delivery
Lectures, demonstrations, group/class discussions and practical tutorial exercises.

Instructional Materials/Equipment:
Lectures should ideally be delivered using projectors to enable adequate illustration of concepts.

Course Assessment:
Students are evaluated on their understanding, as demonstrated by their competence in using the knowledge gained in this course in line with Section 2.5.4iv(a) on evaluation.

Core reading material for the course
1. Classical Mechanics, H. Goldstein, Narosa publishing house, Second Edition 2001
2. Classical Mechanics. S.L.Gupta, V. Kumar & H.V.Sharma-Pragati Prakashan Meerut, 2003

Recommended reference materials
1. Classical mechanics - T. W. B. Kibble, Frank H. Berkshire, Imperial College Press, 2004
2. Classical Mechanics - John Robert Taylor, University Science Books, 2004
3. Classical Mechanics Gupta SI, Kumar V, Sharma HV- Pragati Prakashan 2008

PHY 8104: ELECTRODYNAMICS **4 Credit hours**

Purpose
The aim of this course is to develop the student with an understanding of classical electrodynamics. Thus, Maxwell's equations and their consequences are considered in a great detail and presented pedagogically. Dynamics of the electromagnetic field and electromagnetic radiation are also covered. Further the learner will be able to find solutions of Poisson and Laplace equations.

Learning outcomes
Upon completion of this course, students should be able to demonstrate:
i) Familiarity with solving boundary value problems.
ii) Familiarity with vector calculus and its application in magnetostatics and electrostatics.
iii) Ability to apply Maxwell Equations Coulomb's Law, Gauss' Law, Ampere's law and Faraday's Law

iv) Use computational methods to calculate fields and forces

Course content

Guass's Law; Poisson and Laplace Equations; Green's theorems; Electric dipole and quadrupole moments; Boundary value problems; Dielectrics; Polarizability; Magnestotatisc; scalar and vector potential; magnetic dipole moment; Maxwell equations; Gauge transformations; Wave equation; Polarization; Stoke's parameters; Reflections and refraction at a plane interface; Dispersion and dissipation; Conductors and plasmas; Propagation in the ionosphere; Radiation from an oscillating source; Dipole and quadrupole fields. Antennae; Scattering by fluids; Wave guides; Modes in rectangular wave guides; Resonant cavities

Mode of delivery

Lectures, demonstrations, group/class discussions and practical tutorial exercises.

Instructional Materials/Equipment:

Lectures should ideally be delivered using projectors to enable adequate illustration of concepts.

Course Assessment:

Students are evaluated on their understanding, as demonstrated by their competence in using the knowledge gained in this course in line with Section 2.5.4iv(a) on evaluation.

Core reading material for the course

1. D.J. Griffiths, Introduction to Electrodynamics (third edition, 1999)
2. J.D. Jackson, Classical Electrodynamics (second edition, 1975; third edition, 1999).

Recommended reference materials

1. G.L. Pollack and D.R. Stump, *Electromagnetism* (2002);
2. R.K. Wangsness, *Electromagnetic Fields* (second edition, 1986).
3. M.H. Nayfeh and M.K. Brussel, *Electricity and Magnetism* (1985).
4. R.P. Feynman, R.B. Leighton, and M. Sands, *The Feynman Lectures in Physics*, volumes 1 and 2 (1963). © 2002, University of Rochester

PHY8105: QUANTUM MECHANICS **4 Credit hours**

Purpose

The course introduces Schrödinger equations with solutions in simple potentials, including harmonic oscillator, spherically symmetric potentials with hydrogen-like atoms. Axioms of quantum mechanics are introduced; matrix representation of quantum mechanics is discussed together with approximate methods (variation method, perturbation theory, Born approximations). Program covers spin and angular momentum representations and addition rules and identical particles treatment.

Learning outcomes

By the end of this course the student should be able to:

i. Master central concepts like operators, eigenfunctions, eigenvalues, and the Schrödinger equation, and know the role of these in quantum mechanics,
ii. Apply principles of quantum mechanics to calculate observables on known wave functions.
iii. Solve time-dependent and time-independent Schrödinger equation for simple potentials and harmonic oscillator.
iv. Apply variational method, time-independent perturbation theory and time-dependent perturbation theory (first order) to solve simple problems.
v. Combine spins and angular momenta.

Course content

Preliminary concepts; Application of Schrodinger equation: One dimensional finite square well potential, particle in two and three dimensional box, exchange degeneracy, symmetric and anti-symmetric states, solution of free particle Schrodinger equation in spherical polar coordinates, solution of three dimensional harmonic oscillator in spherical polar coordinates, degeneracy of harmonic oscillator states. Spherically symmetric systems; Linear vector space and operators; Matrix formulation of quantum mechanics and elementary representations theory; Angular momenta and their properties; Time independent quantum approximation methods (stationary perturbation theory, variation method and W.K.B. method); Quantum theory of scattering

Mode of delivery

Lectures, demonstrations, group/class discussions and practical tutorial exercises.

Instructional Materials/Equipment:

Lectures should ideally be delivered using projectors to enable adequate illustration of concepts.

Course Assessment:

Students are evaluated on their understanding, as demonstrated by their competence in using the knowledge gained in this course in line with Section 2.5.4iv(a) on evaluation.

Core reading material for the course

1. Griffiths, D. J. (2005) *Introduction to Quantum Mechanics* 2nd ed. (Pearson Prentice Hall)
2. Advanced Quantum Mechanics, Peters S. Riseborough, 2015

Recommended reference materials

1. Gasiorowicz, S. (2003) *Quantum Physics* 3rd ed. (Wiley), Bransden, B. H., and Joachain, C. J. (2000) *Quantum Mechanics* 2nd ed., (Pearson)

PHY 8106: STATISTICAL MECHANICS **4 Credit hours**

Purpose

The course provides an introduction to statistical physics, mainly for systems in thermal equilibrium. The student should understand quantum and classical statistical mechanics for ideal systems, and be able to judge when quantum effects are important. The student should understand the connection between microphysics and thermodynamics.

Learning outcomes

By the end of this course the student should be able to:

i) explain equilibrium statistical mechanics/ensemble theory;
ii) differentiate between Classical and Quantum Statistics;
iii) define and discuss the concepts of microstate and macrostate of a model system
iv) define and discuss the concepts and roles of entropy and free energy from the view point of statistical mechanics
v) define and discuss the Boltzmann distribution and the role of the equipartition function
vi) explain non-equilibrium statistical mechanics and transport theory.

Course content

Statistical formulation of the mechanical problem. Theory of fluctuation; Brownian motion; Nyquist-Johnson noise; Fluctuation dissipation theorem; Basic methods and results of statistical mechanics. The equipartition theorem. Quantum statistics of ideal gases. Systems of interacting particles. Transport theory using the relaxation time approximation. Near-exact formulation of the transport theory. Transition probabilities and master equation. Fluctuations and Onsager theorem.

Mode of delivery

Lectures, demonstrations, group/class discussions and practical tutorial exercises.

Instructional Materials/Equipment:

Lectures should ideally be delivered using projectors to enable adequate illustration of concepts.

Course Assessment:

Students are evaluated on their understanding, as demonstrated by their competence in using the knowledge gained in this course in line with Section 2.5.4iv(a) on evaluation.

Core reading material for the course

1. Mandl, F. (1998): Statistical Physics, 2nd edition, Wiley
2. F. Reif: Fundamentals of Statistical and Thermal Physics

Recommended reference materials

1. R.K. Pathria, (2005) *Statistical Mechanics,*. Elsevier

2. D. Chandler, (1987) *Introduction to Modern Statistical Mechanics*, Oxford.
3. M. LeBellac, F. Mortessagne and George Batronni, (2004) *Equilibrium and non-equilibrium statistical thermodynamics*, Cambridge.
4. J.R.Doffman. (1999) *An introduction to chaos in non-equilibrium statistical mechanics*, Cambridge.
5. Reif, F. (1965): *Fundamentals of Statistical and thermal Physics*, McGraw-Hill

PHY 8207: ADVANCED LABORATORY TECHNIQUES 4 credit hours

Purpose

The course introduces students to techniques necessary for the candidate's thesis research. This course is carried out under the guidence of a faculty member who in normal circumstances would be a candidate's supervisor for the thesis research.

Learning outcomes

Advanced Laboratory Techniques is a lab-based course. By the end of it the student will be expected to:

1. Read and summarize scientific text,
2. Research a scientific topic,
3. Translate ideas into laboratory prototype,
4. Solve complex problems,
5. Use technology (Word, PowerPoint, Excel, MATLAB, etc.) to communicate and to analyze data,
6. Communicate scientific information through report writing and seminar presentation.

Course content

A laboratory topic is chosen by the candidates from their field of research in consultation with the supervisor.The candidate should then independently carry out investigations in their topic of choice over a period of one semester and prepare a dissertation that is then graded by the supervisor and also give a seminar presentation on the same.

Mode of delivery

Hands-on, discussion with supervisor and fellow students, computer simulations, demonstrations, group/class discussions and practical tutorial exercises.

Instructional Materials/Equipment:

Lectures should ideally be delivered using projectors to enable adequate illustration of concepts.

Course Assessment:

Students are evaluated on their understanding, as demonstrated by their competence in using the knowledge gained in this course in line with Section 2.5.4iv(b) on evaluation.

Core reading material for the course

1. Pam Denicolo and Lucinda Becker *Research Proposal Writting SAGE Publications Ltd* (1998)
2. Willis Yuko Oso and David Onen, A Guide to Writing Research Proposal and Report. A hand Book of Beginning Researchers. Jomo Kenyata Foundation (2009)

Recommended reference materials

As given by the various candidates' supervisors

PHY 8208: DIGITAL ELECTRONICS 4 credit hours

Purpose

To equip the learner with the basic an understanding of digital system design.

Course Objectives:

Upon successful completion of this course students will be able:
To give students a strong foundation in digital electronics and apply the knowledge in the design and analysis of devices.

Course Content:

Logic devices: gates, latches, flip-flops multiplexers, adders, buffers, Bolean algebra, analysis of functions, truth tables and maps, circuit realizations, The equivalent circuit model of the MOS transistor, channel resistance, The complementary MOS inverter, gates, latches, memory elements. Their switching speed and power consumption. Design on silicon: gate arrays. The programmable memory MOS transistors: floating gate and nitride-oxide, The gallium arsenide kind of possibilities, Bipolar logic in the history and in the peripheral elements.

Course Methodology:

Interactive lectures that may include
Group discussions by students at their private times as compelled by a series of assignments. In doing assignments, students will apply these theories and models to concrete physical problems.
Development of physical theory using tools of mathematics. In doing assignments, students use these tools to solve problems
Students may present neatly written, well researched and nicely argued reports on certain research based problems.
Students are expected to work on the "end of chapter" problems as one of the best ways to develop analytic and synthetic thinking skills
Students are also expected to do outside reading, beyond the circulated lecture notes to acquire and ingrain good mastery of the course content.

Instructional Materials/Equipment:
Lectures should ideally be delivered using projectors to enable adequate illustration of concepts, simulations and hands-on lab demonstrations

Course Assessment:
Students are evaluated on their understanding, as demonstrated by their competence in using the knowledge gained in this course in line with Section 2.5.4iv(a) on evaluation.

Core reading material for the course
1. Digital Circuits- Wikibooks**,** 2012
2. Microwave Filters, Impedance-Matching Networks, and Coupling Structures **by** G. Matthaei, E.M.T. Jones, L. Young - SRI **,** 1963

Recommended reference materials
1. Microwave and RF Circuits **by** Lee Edwards - Johns Hopkins University **,** 2001

PHY 8209: SEMICONDUCTOR PHYSICS AND DEVICES 4 Credit hours

Purpose
The aim of the course is to provide students with advanced knowledge in the manufacture and operation of semiconductor devices

Learning outcomes
Having successfully completed the course, students should be able to demonstrate knowledge and understanding in:

i. Manipulating carrier concentrations in a semiconductor device
ii. Calculating conduction processes in a semiconductor
iii. the manufacture of various semiconductor devices like diodes and transistors
iv. differentiating the various types of diodes in terms of operation and manufacture
v. Explain the basic theory and operation of semiconductor devices and applications.
vi. Describe the techniques used in optimizing semiconductor device design.

Course content
Electronic structure; electrons in periodic structures. Semiconductor band structures. Pseudo-potential and method. Doping and carrier concentrations in semiconductors. Optical and transport properties of crystalline and amorphous semiconductors. Junction theory. Boltzmann transport equation. Interaction of

phonons with semiconductors. Excitions. Semiconductors in magnetic fields. Hall effect. Quantum devices
Energy bands. Carrier transport phenomena. Bipolar devices: p-n junctions, bipolar transistors. Unipolar devices: MS Contacts, JFET and MESFET, MIS diode, MOSFET. Microwave devices. Photonic Devices: light-emitting diodes, semiconductor lasers, photo-detectors.

Mode of delivery
Lectures, demonstrations, group/class discussions and practical tutorial exercises.

Instructional Materials/Equipment:
Lectures should ideally be delivered using projectors to enable adequate illustration of concepts.

Course Assessment:
Students are evaluated on their understanding, as demonstrated by their competence in using the knowledge gained in this course in line with Section 2.5.4iv(a) on evaluation.

Core reading material for the course
1. M. Balkanski and R. F. Wallis. 2000. **Semiconductor Physics and Applications.** Published by Oxford University press. ISBN:978-0-19-851740-5

Recommended reference materials
1. Semiconductor Devices Physics 3rd Edition S. M. Sze Wiley (2006)ISBN: 978-0-471-14323-9
2. Introduction to Semiconductor Devices, S. M. Tyagi; John Wiley & Sons.
3. Measurement, Instrumentation and Experimental Design in Physics and Engineering by M. Sayer and A. Mansingh, Prentice Hall, India (2000)

PHY 8210: INTEGRATED ELECTRONICS 4 Credit hours

Purpose
The course is aimed at imparting specialized knowledge in Electronics applicable in industry and in carrying out research and development of electronic systems

Learning outcomes
By the end of this course the student should be able to:
i. Design and implementation of electronic systems for various applications
ii. Analysis of electronic systems
iii. In-depth use of relevant test and measurement equipment
iv. Analysis of dynamical systems

Course content

Analog and Digital Circuits, Analog computation, active filters, logarithmic and antilogarithmic amplifier, sample and hold amplifiers, Instrumentation amplifiers, Lock–in amplifiers, square and triangular wave generators,555 timers. Schmitt trigger. Digital to analog converters (ladder and weighed resistor types), Analog to digital converters (Counter type, successive approximation and dual slope converters), Applications of DACs and ADCs. Neural systems and fuzzy logic; Dynamical systems.

Mode of delivery
Lectures, demonstrations, group/class discussions and practical tutorial exercises.

Instructional Materials/Equipment:
Lectures should ideally be delivered using projectors to enable adequate illustration of concepts.

Course Assessment:
Students are evaluated on their understanding, as demonstrated by their competence in using the knowledge gained in this course in line with Section 2.5.4iv(a) on evaluation.

Core reading material for the course
John Hujjsing.Operational Amplifiers: Theory and Design (2011)ISBN-13: 978-9400705951

Recommended reference materials
1. Mark Balch. Complete Digital Design: A Comprehensive Guide to Digital Electronics and Computer System Architecture Paperback. 2003
2. Paul Horowitz and Winfield Hill. The Art of Electronics 3rd edition. 2015. **ISBN:** 9780521809269

PHY 8211: SOLID STATE PHYSICS **4 Credit hours**

Purpose
The aim of the course is to provide students with advanced knowledge in the structure of materials and their applications in industry.

Learning outcomes
By the end of this course the student should be able to:
i. Describing the electronic structure of materials
ii. Explain optical and transport properties of crystalline and amorphous semiconductors
iii. Discuss energy bands in materials
iv. Describe microwave and photonic devices

Course content

Periodic structures; Phonons and specific heat; Electron states and various methods of energy band calculations; Cohesion of solids; Electron-electron interaction; Optical properties; One electron dynamics; electron-phonon interactions K.P. method; Impurities; Measuring the Fermi surface; Quantum wells; Diamagnetism; Para magnetism and magnetic ordering; Superconductivity

Mode of delivery
Lectures, demonstrations, group/class discussions and practical tutorial exercises.

Instructional Materials/Equipment:
Lectures should ideally be delivered using projectors to enable adequate illustration of concepts.

Course Assessment:
Students are evaluated on their understanding, as demonstrated by their competence in using the knowledge gained in this course in line with Section 2.5.4iv(a) on evaluation.

Core reading material for the course
1. Introduction to Solid State Physics 8th ed.by Charles Kittel (Wiley, NY, 2004)

Recommended reference materials
1. James F Shackelford, " Introduction to Materials Science for Engineers", 7th Edition, Pearson Prentice Hall, 2009
2. Dekker A J, "Solid State Physics", Macmillan and Co., 2000

PHY 8212: ENERGY BANDS, MAGNETISM AND AMORPHOUS MATERIALS
4 Credit hours

Purpose
The course focuses on the energy bands, magnetism and properties of amorphous materials.

Course Objectives:
Upon successful completion of this course students will be able:
i. To explain the energy bands, magnetism and properties of amorphous materials so as to apply the acquired knowledge in the design and analysis of devices.

Course Content:
Energy bands: Nearly free electron approximation, Orthogonalized plane wave method, pseudopotential, Tight binding method and Green function method. Many - body techniques: Hartree and Hartree Fock equations - Free electron gas, Self-consistent field methods, Dielectric response. Magnetism: Quantum theory of diamagnetism and paramagnetism, Ferromagnetism, Exchange integral, Spin waves - magnons - dispersion relation, Ferrimagnetism, Antiferromagnetism. Neil temperature, Quantization of

orbits in a magnetic field, De Haas - van Alphen effect, Non-crystalline solids, Amorphous materials, Diffraction pattern, Glasses, Properties of amorphous materials.

Mode of delivery
Lectures, demonstrations, group/class discussions and practical tutorial exercises.

Instructional Materials/Equipment:
Lectures should ideally be delivered using projectors to enable adequate illustration of concepts.

Course Assessment:
Students are evaluated on their understanding, as demonstrated by their competence in using the knowledge gained in this course in line with Section 2.5.4iv(a) on evaluation.

Core reading material for the course
1. Physical Foundations of Solid-State Devices Prof. E. F. Schubert
2. Ashcroft, Neil W.; Mermin, N. David Solid State Physics. Brooks/Cole ISBN-13: 9780030839931

Recommended reference materials
1. Ziman, J. M. Principles of the Theory of Solids (2 Edition). Cambridge University Press ISBN-13: 9780521297332

PHY 8213: THERMAL BEHAVIOUR OF MATERIALS 4 Credit hours

Purpose
The course provides the basic laws and relationships of Thermodynamics and their application to multicomponent systems.

Learning outcomes
By the end of the course the student should be able to:
i. explain thermodynamics concepts as applied in materials
ii. perform equilibrium calculations of multicomponent systems
iii. perform thermodynamic calculations using the laws of thermodynamics
iv. use and read binary phase diagrams
v. formulate and solve thermodynamic problems for simple real materials and processes

Course content
Advanced thermodynamic treatment of inorganic materials. Application of the laws of thermodynamics to the chemical behavior of materials. Multicomponent systems, phase and chemical reactions equilibrium. Thermodynamics of phase transformations. Introduction to surface thermodynamics.

Mode of delivery
Lectures, demonstrations, group/class discussions and practical tutorial exercises.

Instructional Materials/Equipment:
Lectures should ideally be delivered using projectors to enable adequate illustration of concepts.

Course Assessment:
Students are evaluated on their understanding, as demonstrated by their competence in using the knowledge gained in this course in line with Section 2.5.4iv(a) on evaluation.

Core reading material for the course
1. Goran Grimval. 1999. Thermophysical Properties of Materials. ISBN: 978-0-444-82794-4

Recommended reference materials
1. Santosh Kumar Joshi. 2012. Thermal Behaviour of Amorphous Materials: Polymers and Glasses. ISBN-13: 978-3846581421

PHY 8214: ELECTRICAL, MAGNETIC AND OPTICAL PROPERTIES OF SOLIDS
4 Credit hours

Purpose
The course focuses on the properties of solids

Learning outcomes
Upon successful completion of this course students will be able:
i. To explain the physical properties of solids
ii. T apply knowledge in the design and analysis of devices.

Course Content:
Contact phenomena, carrier injection, space-charge-limited currents, thermally stimulated currents, Permittivity, Dielectric loss and breakdown, Potential as function of frequency, temperature and composition. Band states, localised states and states in amorphous materials, Percolation theories of charge transport, Classification of magnetic materials, magnetic anisotropy, magnetorestriction and microscopic explanations, Ferromagnetic walls and patterns, Normal and inverse spinal ferrimagnetism, Ferro and ferrimagnetic materials and their special properties, Induced and natural Birefringence, Dispersion and Absorption, Colour centres and Exitons, Optical transition in impure crystals, their measurements and applications.

Mode of delivery
Lectures, demonstrations, group/class discussions and practical tutorial exercises.

Instructional Materials/Equipment:
Lectures should ideally be delivered using projectors to enable adequate illustration of concepts.

Course Assessment:

Students are evaluated on their understanding, as demonstrated by their competence in using the knowledge gained in this course in line with Section 2.5.4iv(a) on evaluation.

Core reading material for the course

1. Physical Foundations of Solid-State Devices Prof. E. F. Schubert
2. Solid-State Devices by E. F. Schubert
3. Ashcroft, Neil W.; Mermin, N. David Solid State Physics. Brooks/Cole ISBN-13: 9780030839931

Recommended reference materials

1. Marder, Michael P. Condensed Matter Physics (2 Edition). John Wiley & Sons, Incorporated ISBN-13: 9780470617984
2. Ziman, J. M. Principles of the Theory of Solids (2 Edition). Cambridge University Press ISBN-13: 9780521297332

PHY 8215: RENEWABLE ENERGY TECHNOLOGIES 4 Credit hours

Purpose

The aim of the course is to enable students understand the sources of renewable energy and its utilization in the modern world

Learning outcomes

On completion of this course, the student should be able to:

i. Demonstrate a systematic knowledge of the background of renewable energy in the world
ii. Have developed a critical and analytical approach to law and policy challenges of renewable energy projects
iii. Demonstrate a comprehensive understanding of the risk employed in renewable energy projects and obtain the ability to propose ways to mitigate their impact
iv. Appraise current technologies of utilizing renewable-energy sources and evaluate critically respective R&D activities required
v. Assess the potential and economic viability of the utilization of a renewable-energy source at a particular location
vi. Make sound judgement in the absence of complete data and communicate effectively conclusions obtained.

Course content

Introduction to renewable energy sources: (biomass, wind energy, ocean current energy) and limitations; Renewable energy conversion pathways, solar spectra- natural radiation, material science for solar energy conversion systems; Photosynthesis- its relation to energy production; Thin film Technology- Deposition of thin films, methods of thin film deposition; solar thermal- Solar collector surfaces, selectively solar absorbing surfaces, Energy conservation and thermal properties, models for microstructure and thermal & optical properties, degradation and durability (accelerated ageing tests, modeling of optical properties during ageing, lifetime evaluations, degradation kinetics of solar absorber coatings); Solar cells and solar

cell types- Photoelectric, Photovoltaics, Photo electrochemical solar cells (principles, characterizing and analyzing solar cells, types and kinds of each type), Installation and care of PV systems

Mode of delivery
Lectures, demonstrations, group/class discussions and practical tutorial exercises.

Instructional Materials/Equipment:
Lectures should ideally be delivered using projectors to enable adequate illustration of concepts.

Course Assessment:
Students are evaluated on their understanding, as demonstrated by their competence in using the knowledge gained in this course in line with Section 2.5.4iv(a) on evaluation.

Core reading material for the course
1. John Twidell and Tony Weir, “Renewable Energy Resources,” (2000) E & F N SPON Taylor and Francis Group
2. C. G. Granqvist, Editor, Materials Science for Solar Energy Conversion Systems, Pergamon, Oxford, UK, 1991.
3. C. G. Granqvist and T. S. Erikson, in Materials Science for Solar Energy Conversion Systems, Edited by C. G. Granqvist, Pergamon, Oxford, UK, 1991.

Recommended reference materials
1. Electronic Thin Film Science for Electrical Engineers and Materials Scientists, by K.N. Tu, J.W. Mayer and L.C. Feldman, MacMillan Publishing Co, New York, 1992.
2. The Materials Science of Thin Films, by M. Ohring, Academic Press, Boston, 1991.
3. Modular Series on Solid State Devices Vol. VI, "Advanced Semiconductor Fundamentals," by R.R. Pierret, Addison
4. Modular Series on Solid State Devices Vol. VIII, "Quantum Phenomena," by S. Datta, Addison Wesley, 1989. Wesley, 1989
5. Physics and Applications of Semiconductor Microstructures, by M. Jaros, Oxford Science, 1989.
6. Quantum Semiconductor Structures, by C. Weisbuch and B. Vinter, Harcourt Brace, 1991.

4.0 APPENDICES

4.1 Appendix I: Facilities

S/N	Name of Facility	Number	Capacity	Usage
1	Lecture rooms	67	80 X67 per session	Shared
2	Internet Access points	All learning facilities	-	Shared
3	Maasai Mara university Library	1	200	shared

4.2 Appendix II: Equipment and Teaching Materials

S/N	Name of Equipment	Number	Capacity	Usage
1	Projector	2	20 students	Shared
2	White boards			Shared
3	Laptop	3		Shared
4	White board marker			Individual
5				

4.3 Appendix III: Core-Texts and Journals

S/N	Subject Area: Physics	Number of Titles	Volumes
Core-Texts (Print)			
1.	Classical mechanics	20	10
2.	Quantum mechanics	30	20
3.	Statistical mechanics	12	8
4.	Mathematical physics	15	7
5.	Spectroscopic techniques	42	20
6.	Electrodynamics	12	8
7	Optics	26	16
8	Materials science	32	25
9	Optoelectronics and spintronics	8	4
10.	Digital electronics	24	15
11	Analog electronics	18	12

12	Renewable energy	40	35
13	Magnetism	16	12
14	Thermodynamics	12	10
15	Solid state physics	12	6
16	Atomic and particle physics	22	12
17	Mossbauer effect	3	3
18	Photonics	5	4
19	Astrophysics and space physics	2	1
20	Computational physics	3	2
21	Geology	7	5
22	Semiconductor physics	6	5
Core Texts (Electronic)			
1.	Classical mechanics	20	10
2.	Quantum mechanics	30	20
3.	Statistical mechanics	12	8
4.	Mathematical physics	15	7
5.	Classical mechanics	20	10
6.	Materials science	32	25
7	Electrodynamics	12	8
8	Renewable energy	40	35
Journals (Electronic)			
1.	Physics journals	75	75
Journals (Print)			
1.	Physics journals	18	11

4.4 Appendix IV: Academic Staff

Name	Teaching Experience	Professional Experience	Publications	Patents	ACADEMIC QUALIFICATIONS						Academic Rank	Workload per Year	Mode of engagement
					Bachelors		Masters		PhD				
					University	Date	University	Date	University	Date			
Prof Justus Simiyu	24	20	47	0	Nairobi University	1996	University of Nairobi	2001	University of Nairobi & Uppsala University, Sweden	2010	Ass Professor	2 Courses	Full time
Dr. Fredrick Otieno	16	7	10	0	Kenyatta University	1992	University of Nairobi	1999	Jomo Kenyatta University of Science and technology	2007	Senior Lecturer	2 courses	Full time
Dr. Isaac Motochi	5	2	6	0	Moi University	1998	Moi University	2010	University of the Witwatersrand	2015	Lecturer	3 course	Full time
Dr. Ing Jared Ombiro Gwaro	14	12	19	0	Egerton University	2007	Egerton University	2010	Ruhr Universitat Bochum	2019	Lecturer	3 courses	Full Time
Dr.KENNETH KIPCHUMBA SIRMA	10	10	17	0	Moi University	2010	University of Eldoret	2014	University of Eldoret	2021	Lecturer	3 courses	Full Time
Dr. Duke Oeba	14	12	19	0	Egerton University	2008	Kenyatta Unversity	2018	University of south Africa	2021	Lecturer	3 courses	adjunct

4.5 Appendix V: Policy on Curriculum Development

MAASAI MARA UNIVERSITY

CURRICULUM DEVELOPMENT AND REVIEW POLICY

Version Number	**001**	
Revision Number	**001**	
Document Status	**Draft**	
Date Approved		
Approved By		
Effective Date		
Department Responsible		**Directorate of Quality Assurance and Performance Contracting**

Foreword

To achieve her vision of being a *World Class University Committed to Academic Excellence for Development*, Maasai Mara University (MMU) need to continually develop, review and implement market demand driven academic programmes which meet the needs of a highly dynamic labour market. The Universities Standards and Guidelines 2014 define an academic programme as learning content consisting of courses that are weighed in terms of credit hours and are taught within a stipulated timeframe. There is therefore need to put in place a robust policy that will guide development and continuous review of academic programmes at Maasai Mara University. An academic programme is a dynamic document reviewed regularly in a predetermined cycle in order to align it with the prevailing needs of a market, local or world trends in education and the ever-changing backgrounds of students.

This policy therefore provides an avenue for a participatory approach to curriculum development and review process at Maasai Mara University to ensure standards of quality are met as well as form a basis for stakeholder involvement. It is envisaged that effective implementation of this policy will ensure that programmes on offer at MMU are of high standard of quality and relevance.

Prof. P. Aloo-Obudho, PhD., EBS

Professor of Fisheries Ecology

Vice-Chancellor