

MSc Physics with Specialisation in Renewable Energy - SC536 (Subject to Approval)

1. Specific Titles

- 1) MSc Physics with Specialisation in Renewable Energy
- 2) Postgraduate Diploma in Physics with Specialisation in Renewable Energy
- 3) Postgraduate Certificate in Physics with Specialisation in Renewable Energy

2. Objectives

This Masters programme caters for science post-graduate students who wish to prepare themselves for a career in the exponentially expanding field of renewable energy systems. The course adopts a holistic approach that focuses on the theoretical, technical and practical aspects of energy use as well as its economic and environmental dimensions.

3. General Entry Requirements

Successful completion of an undergraduate degree with

- at least a Second Class or CPA $\geq 50\%$, whichever is applicable or
- a GPA not less than 2.5 out of 4 or equivalent, from a recognised higher education institution.

OR alternative qualifications acceptable to the University of Mauritius.

4. Programme Requirements

BSc (Hons) Physics or BSc (Joint Hons) Degree with Physics as one of the subjects or equivalent qualifications acceptable to the University of Mauritius.

5. General and Programme Requirements – Special Cases

The following may be deemed to have satisfied the General and Programme requirements for admission:

- (i) Applicants who do not satisfy any of the requirements as per Regulations 3 and 4 above but who submit satisfactory evidence of having passed examinations which are deemed by the Senate to be equivalent to any of those listed.
- (ii) Applicants who do not satisfy any of the requirements as per Regulations 3 and 4 above but who in the opinion of Senate submit satisfactory evidence of the capacity and attainments requisite to enable them to pursue the programme proposed.
- (iii) Applicants who hold a full practising professional qualification obtained by examination.

6. Programme Duration

The Programme is offered either on a full-time (F/T) and/or a part-time (P/T) basis. The duration of the Postgraduate Programme should normally not exceed 2 years (4 semesters) for F/T and 4 years (8 semesters) for P/T.

7. Credits per Semester: Minimum 3 credits subject to Regulation 6.

8. Minimum Credits Required for Awards

Master's Degree:	39
Postgraduate Diploma:	24
Postgraduate Certificate:	12

Breakdown as follows:

	Core Taught modules	Project	Electives
Master's Degree	18	12	9 ^a
Postgraduate Diploma	18		6 ^b
Postgraduate Certificate	12		

^a A minimum of 9 credits from departmental electives including at least 6 credits from electives with a PHYRE code.

^b A minimum of 6 credits from departmental electives including at least 3 credits from electives with a PHYRE code.

9. Assessment

Each module can either be taught in semester 1 only or in semester 2 only or throughout the two semesters.

Modules wholly taught in one semester are termed semester modules whereas modules taught throughout the two semesters are termed yearly modules.

Each module will carry 100 marks and will be assessed as follows (unless otherwise specified):

Assessment will be based on a written examination of 3-hour duration and continuous assessment carrying a range of 30% to 40% of total marks. Continuous assessment may be based on laboratory works and/or assignments and/or seminars and should include at least 1 class test.

Written examinations for semester modules will be held in the semester they are taught in. Yearly modules will be examined at the end of the year.

An overall total of 40% for combined Continuous Assessment and Written Examination components would be required to pass a module, without minimum thresholds within the individual Continuous Assessment and Written Examination.

10. Plan of Study

Students are required to submit at the end of Semester 1 a Plan of Study for their whole Programme of Studies, indicating the list of electives modules and in which semester each of them will be taken.

The University reserves the right not to offer a given elective module if the critical number of students is not attained and/or for reasons of resource constraints.

11. Important Note

The rules as stipulated in this Programme Structure and Outline Syllabus will replace all other rules and regulations found in previous Programme Structures.

12. List of Modules

Code	Module Name	Hrs/Wk L + P	Credits
<u>CORE MODULES</u>			
PHYSI 6001(7)	Electromagnetic Phenomena	3 + 0	3
PHYSI 6002(7)	Quantum Mechanics II	3 + 0	3
PHYSI 6003(7)	Statistical Mechanics	3 + 0	3
PHYSI 6004(7)	Optics and Photonics	3 + 0	3
PHYRE 6001(7)	Energy Systems and Management	3 + 0	3
PHYRE 6002(7)	Energy for Sustainable Development	3 + 0	3
<u>PROJECT</u>			
PHYSI 6000Y(7)	Research Project	-	12
<u>ELECTIVES</u>			
PHYRE 6003(7)	Solar Energy	2 + 2	3
PHYRE 6004(7)	Water and Wave energy	2 + 2	3
PHYRE 6005(7)	Wind Energy	2 + 2	3
PHYRE 6006(7)	Bioenergy	2 + 2	3
PHYRE 6007(7)	Power Generation and transmission	2 + 2	3

And/or other modules approved by the department.

Note: Not all electives may be on offer. The list of modules is not exhaustive.

13. Programme Plan - MSc Physics with Specialisation in Renewable Energy**Full-Time****YEAR 1**

Code	Module Name	Hrs/Wk L+P	Credits
CORE			
PHYSI 6000Y(7)	Research Project	-	-
PHYSI 6001(7)	Electromagnetic Phenomena	3 + 0	3
PHYSI 6002(7)	Quantum Mechanics II	3 + 0	3
PHYSI 6003(7)	Statistical Mechanics	3 + 0	3
PHYSI 6004(7)	Optics and Photonics	3 + 0	3
PHYRE 6001(7)	Energy Systems and Management	3 + 0	3
PHYRE 6002(7)	Energy for Sustainable Development	3 + 0	3
ELECTIVES			
PHYRE 6003(7)	Solar Energy	2 + 2	3
PHYRE 6004(7)	Water and Wave energy	2 + 2	3
PHYRE 6005(7)	Wind Energy	2 + 2	3
PHYRE 6006(7)	Bioenergy	2 + 2	3
PHYRE 6007(7)	Power Generation and transmission	2 + 2	3

And/or other modules approved by the department.

Note: Not all electives may be on offer. The list of modules is not exhaustive.

Part-Time

YEAR 1

Code	Module Name	Hrs/Wk L+P	Credits
CORE			
PHYSI 6001(7)	Electromagnetic Phenomena	3 + 0	3
PHYSI 6002(7)	Quantum Mechanics II	3 + 0	3
PHYSI 6003(7)	Statistical Mechanics	3 + 0	3
PHYSI 6004(7)	Optics and Photonics	3 + 0	3
PHYRE 6001(7)	Energy Systems and Management	3 + 0	3
PHYRE 6002(7)	Energy for Sustainable Development	3 + 0	3

YEAR 2

Code	Module Name	Hrs/Wk L+P	Credits
CORE			
PHYSI 6000Y(7)	Research Project	-	-
ELECTIVES			
PHYRE 6003(7)	Solar Energy	2 + 2	3
PHYRE 6004(7)	Water and Wave energy	2 + 2	3
PHYRE 6005(7)	Wind Energy	2 + 2	3
PHYRE 6006(7)	Bioenergy	2 + 2	3
PHYRE 6007(7)	Power Generation and transmission	2 + 2	3

And/or other modules approved by the department.

Note: Not all electives may be on offer. The list of modules is not exhaustive.

14. **Outline Syllabus**

This outline syllabus is not prescriptive and is intended to serve as a guide only.

CORE MODULES

PHYSI 6000Y(7) - RESEARCH PROJECT

The student must undertake a research project work on a topic approved by the department.

PHYSI 6001(7) - ELECTROMAGNETIC PHENOMENA

Electromagnetic wave equation. Electromagnetic wave propagation. Generation (and sources) of electromagnetic waves. Polarisation. Interference. Diffraction. Electromagnetic wave scattering. Electromagnetic fields. Electromagnetic radiation.

PHYSI 6002(7) - QUANTUM MECHANICS II

Introduction: concepts of quantum mechanics and conservation laws in quantum mechanics. Perturbation theory: time independent and time dependent. Spin. Identity of particles. Radiation from atoms. Some selected topics.

PHYSI 6003(7) - STATISTICAL MECHANICS

Thermodynamics. Statistical methods. Systems & particles. Statistical thermodynamics. Ensembles. Quantum statistics. Fluctuations. Phase transitions. Applications.

PHYSI 6004(7) - OPTICS AND PHOTONICS

Review of basic concepts. Geometrical optics. Coherence theory. Fourier optics. Optical systems. Lasers. Imaging. Holography. Guided optics and optical devices.

PHYRE 6001(7) – ENERGY SYSTEMS AND MANAGEMENT

Concepts in energy systems implementation. Co-generation systems. Waste heat utilization. Strategies for incorporating renewable and non-renewable energy energies. Energy auditing and management. Carbon dioxide emissions limitations and moeconomics. CO₂ sequestration. Public policy, financial operations and regulations: their effect on the energy sector. Large Independent Power Producers. Small residential grid-tie systems. Case study.

PHYRE 6002(7) – ENERGY FOR SUSTAINABLE DEVELOPMENT

Energy and Social Issues. Energy, the Environment and Health. Energy Security. Energy Resources. Energy End-Use Efficiency. Renewable Energy Technologies. Advanced Energy Supply Technologies. Energy Scenarios. Rural Energy. Reshaping Markets and Building Capacity. Key Policy Areas for Sustainable Development

ELECTIVE MODULES**PHYRE 6003(7) – SOLAR ENERGY**

Sun, Solar spectrum, Solar radiation, Pyrheliometer, Pyranometer. Flat-Plate Collectors: Classification, Heat transfer coefficients, Thermal analysis of flat-late collectors. Evacuated Solar Collector: Evacuated-tube cover collector, Evacuated-tunular collector, Evacuated tube collector with heat pipe. Solar water heating system: Heat exchanger, Heat collection in a storage tank, Solar water heaters, Solar Concentrators, Solar Distillation. Photovoltaic energy conversion: physics of solar cells, solar cell materials and technology, PV modules and systems.

PHYRE 6004(7) – WATER AND WAVE ENERGY

Hydro electricity: Dam and damless based Hydro-electric generators and turbines. Hydro-electric potential. Wave Energy: Wave characteristics and distribution. Wave physics. Wave potential. Power devices and extraction. Tidal Energy: Tides characteristics. Energy from tidal cycle. Existing schemes. Other types of Hydro Energy. Environment impact.

PHYRE 6005(7) – WIND ENERGY

Fluid motion. Boundary layer flow. Incompressible & compressible flows. Turbulence. Aerofoils. Actuator disc theory. Betz equation. Wake rotation. Blade element theory. Hydraulic machines: vertical and horizontal axis. Power and drag coefficients. Rated power and load factor. Wind farm siting. Wind energy and the environment. Structural design of tower. Meteorology. Economics of wind energy generation. Examples of wind generators: Practical investigation.

PHYRE 6006(7) – BIOENERGY

Typesof biomass. Feedstock supply. Composition of lignocellulose energy crops; chemical and enzymatic pre-treatment. Direct biomass combustion. Biodiesel. Biomethane. Bioethanol. Gasification of biomass. Biohydrogen.

PHYRE 6007(7) –POWER GENERATION AND TRANSMISSION

Review of monophas AC Circuits. Power and power factor. Polyphase AC. Balanced three-phase circuits. Per phase analysis. Complex Power measurements. Ideal monophas and three phase transformers. Iron and Copper losses. Real Transformer model. Introduction to per unit systems. Electric power generation. Power transmission systems. Introduction to Load Flow.

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