

## MASTER OF SCIENCE AND DOCTOR OF PHILOSOPHY IN PHYSICS

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The Department of Physics offers a series of Postgraduate courses to be taken by students registered for the Msc. and PhD degrees in Physics. These will be given in the following areas.

PHY 510: Mathematical Methods

PHY 520: Advanced

PHY 542: Statistical Mechanics

PHY 553: Classical Electrodynamics

PHY 572: Advanced Quantum Mechanics

### Detailed Syllabus

PHY 510: Mathematical Methods

(20 lectures)

1. **Matrices** A review (if necessary)
2. **Tensors** Expectation values; Probabilities
3. Heisenberg, Schrodinger and Interaction Pictures
4. Time-dependant perturbation theory Selection rules. (Light Scattering)
5. Second quantization
6. Schwinger's Action Principles and canonical quantization rules
7. Identical particles
8. **Scattering theory** Green's function (and Born approximation, etc)  
The distorted Born approximation Scattering of a wave shift and cross-sections  
Dispersion relations; Regge poles

9. The S-Matrix (time-independent)
10. Symmetries and Conservation laws

### Relativistic

11. The Dirac and Klein-Gordon equations  
"Properties" of the Dirac equation  
Solutions of the Dirac equation: plane waves; Hydrogen atom
12. Second quantization (bosons and fermions)
13. Lagrangian field theory  
Field equations for photons, electrons and mesons  
Solution of field equations (include Klein-Gordon):  
Singular functions  
Fourier decomposition of free fields
14. Schwinger's Action Principle and its conservation laws (energy-momentum, angular momentum and charge)
15. Interacting fields  
Bare fields and renormalization  
Perturbation theory (interaction picture)
16. Propagator methods  
Feynman graphs, etc.

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## PH.D CHEMISTRY BY RESEARCH

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Those who hold Msc. in Chemistry are eligible for registration for Ph.D. by research..

The final examination of research degree (Msc. or Ph.D.) is a thesis which in most cases must be orally defended. The thesis must be of high quality and the findings described in the thesis must make a significant contribution to knowledge that is to say the main emphasis is on originality. The major areas of research

interests in the Department at the moment are analytical/environmental chemistry. Coordination chemistry including reaction kinetics, surface chemistry and heterogeneous catalysis, extraction and isolation of natural products of medicinal value such as alkaloids, prostglandins, and oils, clay minerals, Paper manufacture, Lake Katwe Salt Project.

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## DOCTOR OF PHILOSOPHY IN BOTANY (Ph.D. BOTANY)

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Graduates with first class degrees in Botany with another subject may register for Ph.D. Research Work in the department. This reflects the special interests of members of staff and this determines the choices available for prospective research students. Branches of Botany in which research is at present possible include terrestrial ecology

(mainly grasslands); papyrus swamp ecology; seed germination; mycology; flowering plant taxonomy; freshwater biology and genetics. The department shares research interests with the Uganda Institute of Ecology which is situated at Mweya in Rwenzori National Park.