BSc (Hons) Physics*/MSc Physics/MSc Physics with Specialisation# - SC343 (Under Review)

*Optional Minor: Astrophysics/Biology/Chemistry/ Instrumentation/ Mathematics/ Renewable Energy
#Specialisation in: Computing and Applications/Astrophysics/Renewable Energy/ Forensic Science

1. Objectives

One of the most important concepts in physics is that, behind the apparent complexity of the world around us, nature has an underlying simplicity and unity which can be expressed in terms of all-embracing fundamental principles and laws. As well as being concerned with such fundamental questions, physics is a widely applicable subject and forms the basis of much of modern and, more importantly, future technologies. Moreover, the distinction between certain traditional branches of other disciplines and physics is rapidly fading out, resulting in an increasing number of employment opportunities in technical areas requiring expertise at the interface of physics and these disciplines.

Our BSc (Hons)/MSc degree programme has been developed to provide a solid grounding in physics as a fundamental discipline while providing a secure foundation to a wide range of careers. To enhance accessibility to the various existing and probable future career opportunities, apart from modules in core areas of physics, we also offer a variety of electives in applied and theoretical areas of physics as well as in other optional scientific disciplines. Overall, our programme combines the study of a fundamental discipline with the opportunity to develop skills in experimental and theoretical methods of problem solving.

Depending on their specific interests and aptitudes, our graduates may opt for traditional careers like teaching or for jobs in technical areas of research and development in industry, laboratories and universities. The analytical and problem solving skills of physicists are also appreciated worldwide in areas like computing and even in areas like management, finance and law. In addition, our programme offers the appropriate background for specialisation through further studies, or research at postgraduate level, both locally and overseas. Some of our successful graduates have pursued further studies in Physics, Computer Applications, Medical Physics and PhDs in Solid State Physics, Radio Astronomy (related to the Mauritius Radio Telescope), High Energy Physics, Computational Physics and Functional Magnetic Resonance Imaging.

2. General Entry Requirements

As per General Entry Requirements for admission to the University for undergraduate degrees.

3. Programme Requirement

Passes at GCE 'A' Level in Mathematics and Physics.

To enroll for the MSc Programme, i.e. Year 4, the student should satisfy all the requirements for the award of BSc (Hons) Physics and should have a CPA of at least 50%.

Note: Students will have to indicate if they wish to proceed to the MSc Programme at the end of their second year of study. Students enrolled for the MSc programme will be charged tuition fees.

4. Programme Duration

	Normal	Maximum
BSc (Hons) Physics	6 Semesters	10 Semesters
Postgraduate Diploma in Physics	8 semesters	12 semesters
MSc Physics/MSc Physics with Specialisation	8½ semesters	12½ semesters

5. Credit System

15 Hours Lectures and/or Tutorials - 1 Credit
15 Hours of Practical Work - 0.5 Credit

6. Credits per Year

Minimum 18 credits; Maximum (including retake modules): 48 credits

7. Minimum Credits Required for Awards

MSc Degree: 140 (101 + 39)
Postgraduate Diploma: 125 (101 + 24)
Postgraduate Certificate: 113 (101 + 12)
BSc (Hons) Degree: 101

Breakdown as follows:

	Core Taught modules	Project(s)	Electives
Master's Degree	75 + 18	8 + 12	18[c] + 9[a]
Postgraduate Diploma	75 + 18	8	18[c] + 6[b]
Postgraduate Certificate	75 + 12	8	18[c]
Bachelor's Degree	75	8	18[c]

[a] A minimum of 9 credits from departmental electives including at least 6 credits from electives in one of the following specialisation: Computing and Applications, Astrophysics, Renewable Energy, Forensic Science, where applicable.

[b] A minimum of 6 credits from departmental electives including at least 3 credits from electives in one of the following specialisation: Computing and Applications, Astrophysics, Renewable Energy, Forensic Science, where applicable.

[c] 18 credits from year 2 and year 3 electives, with a minimum of 12 credits in one of the following optional Minors: Astrophysics, Instrumentation, Renewable Energy, Biology, Chemistry, and Mathematics, where applicable.

8. 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 two semesters are termed yearly modules.

Each module will be assessed over 100 marks with details as follows (unless otherwise specified).

Assessment will be based on a written examination of a paper of 2 to 3-hour duration (normally a paper of 2 hour duration for modules carrying 3 credits or less, 2½ hour paper for modules carrying 3.5-4.5 credits and 3 hour paper for modules carrying 5 to 6 credits) and on continuous assessment done during the semester or year.

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.

The continuous assessment will count for 20 to 30% of the overall percentage mark for the module(s) unless specified otherwise. Continuous assessment may be based on laboratory work, seminars and/or assignments should include at least two (2) assignments/tests per year per module.

There will be a compulsory class test at the end of semester 1 for all modules taught in semester 1 and which are examined at the end of semester 2 of the given academic year, unless otherwise stated in the Programme Structure.

An overall total of 40% for combined continuous assessment and written examination components would be required to pass the module, without minimum thresholds within the individual continuous assessment and written examination.

In case of yearly modules, special examinations (e.g. class tests) will be arranged at the end of semester 1 or semester 2 for exchange students who have registered only for one semester; credits will be assigned on a pro-rata basis.

The following modules will carry 100 marks each and will be assessed solely by continuous assessment:

Physics Lab I – PHYSI 1006Y(3)
Physics Lab II – PHYSI 2106(3)
Experiment Design – PHYSI 2206(3)
Numerical and Scientific Computing I – PHYCO 1201(1)
Operating Systems and Scientific Softwares – PHYCO 1100(1)
Advanced Practicals – PHYSI 6009(7)

Modules will carry the weightings of 1, 3 or 5 depending on their status (Introductory, Intermediate or Advanced). Weighting for a particular module is indicated within parentheses in the module code.

9. List of Modules

A. Physics Core Modules (75 + 8 + 18 +12 credits)

Code	Module Name	Hrs /Wk L+P	Credits
PHYCO 1100(1)	Operating Systems and Scientific Softwares	2+2	3
PHYCO 1201(1)	Numerical & Scientific Computing I	2+2	3
PHYSI 1101(1)	Mathematical Techniques for Physicists I	3+0	3
PHYSI 1201(1)	Mathematical Techniques for Physicists II	3+0	3
PHYSI 1102(1)	Mechanics I	3+0	3
PHYSI 1203(1)	Physics of Matter	3+0	3
PHYSI 1104(1)	Waves & Optics I	3+0	3
PHYSI 1204(1)	Electromagnetism I	3+0	3
PHYSI 1105(1)	Electric Circuits & Electronics	3+0	3
PHYSI 1006Y(3)	Physics Lab I	0+3	3
PHYSI 1107(1)	Thermal Physics	3+0	3
PHYSI 1208(1)	Quantum Physics	3+0	3
PHYSI 1009(1)	Introduction to Astronomy	3+0	3
PHYSI 2101(3)	Maths for Physicists I	3+0	3
PHYSI 2201(3)	Maths for Physicists II	3+0	3
PHYSI 2002(3)	Mechanics II	3+0	3
PHYSI 2203(3)	Optics II	3+0	3
PHYSI 2104(3)	Electromagnetism II	3+0	3
PHYSI 2005(3)	Quantum Mechanics I	3+0	3

PHYSI 2106(3)	Physics Lab. II	0+3	1.5
PHYSI 2206(3)	Experiment Design	0+3	1.5
PHYSI 3000Y(5)	Project/Dissertation	–	8
PHYSI 3001(5)	Nuclear Physics	3+0	3
PHYSI 3102(5)	Atomic & Molecular Physics	3+0	3
PHYSI 3003(5)	Elementary Particle Physics	3+0	3
PHYSI 3104(5)	Statistical Physics	3+0	3
PHYSI 3006(5)	Solid State Physics I	3+0	3

Common to all MSc Programmes

PHYSI 6000Y(7)	Research Project	–	12
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

MSc Physics

PHYSI 6005(7)	Mechanics	3+0	3
PHYSI 6006(7)	Physics of Fluids	3+0	3

MSc Physics with Specialisation in Computing and Applications

PHYCO 6001(7)	Fundamentals of Computer Simulations	2+2	3
PHYCO 6002(7)	Advanced Signal Processing	2+2	3

MSc Physics with Specialisation in Astrophysics

PHYAS 6003(7)	Stellar Astrophysics	3+0	3
PHYAS 6005(7)	Galactic and Extragalactic Astronomy	3+0	3

MSc Physics with Specialisation in Renewable Energy

PHYRE 6001(7)	Energy Systems and Management	3 + 0	3
PHYRE 6002(7)	Energy for Sustainable Development	3 + 0	3

MSc Physics with Specialisation in Forensic Science

PHYFS 6001(7)	Ballistic, explosions, fire propagation	2.5+1	3
PHYFS 6002(7)	Vehicle collisions reconstruction	2.5+1	3

B. Physics Electives (Not all electives may be on offer)

Departmental

PHYEL 2007(3)	Electronics & Communications	2+2	3
PHYEL 2010(3)	Computational Physics	2+2	3
PHYEL 3005(5)	Classical Mechanics	3+0	3

PHYEL 3007(5)	Medical Physics	3+0	3
PHYEL 3009(5)	Electromagnetic Theory	3+0	3

Optional Minors

Astrophysics

PHYAS 2008(3)	Astrophysics I	2.5+1	3
PHYAS 2011(3)	Astronomical Techniques I	2+2	3
PHYAS 3008(5)	Astrophysics II	2.5+1	3
PHYAS 3011(5)	Astronomical Techniques II	2+2	3
PHYAS 3012(5)	Extragalactic Astronomy and Cosmology	2.5+1	3

Instrumentation

PHYIN 2012(3)	Electronics in Instrumentation I	2.5+1	3
PHYIN 2013(3)	Measurement & Sensors	2.5+1	3
PHYIN 2015(3)	Statistical Methods for Physicists	2.5+1	3
PHYIN 3012(5)	Electronics in Instrumentation II	2+2	3

Renewable Energy

PHYRE 2016(3)	Renewable Energy Resources I	2.5+1	3
PHYRE 2017(3)	Renewable Energy Resources II	2.5+1	3
PHYRE 2018(3)	Automatic Control and Regulation	2.5+1	3
PHYRE 2019(3)	Climate Dynamics	2.5+1	3
PHYRE 3014(5)	Energy Conservation	2.5+1	3
PHYRE 3015(5)	Energy Systems	2.5+1	3
PHYRE 3016(5)	Physics of the Atmosphere	2.5+1	3

Biology/Chemistry/Mathematics

Students will have to choose the optional minor modules for Biology, Chemistry or Mathematics from the respective department.

MSc Physics

PHYSI 6007(7)	Solid State Physics II	3+0	3
PHYSI 6008(7)	Microwaves and Materials	3+0	3
PHYSI 6009(7)	Advanced Practicals	0+9	3
PHYSI 6010(7)	Dynamical Systems and Chaos	3+0	3
PHYSI 6011(7)	Artificial Intelligence Tools	3+0	3
PHYSI 6012(7)	Alternative Energy Resources	3+0	3

MSc Physics with Specialisation in Computing and Applications

PHYCO 6003(7)	Computer-Oriented Statistical Physics	2+2	3
PHYCO 6004(7)	Applied Computational Fluid Dynamics	2+2	3
PHYCO 6005(7)	Computational Electromagnetics	2+2	3
PHYCO 6006(7)	Quantum Computation, Communication & Cryptography	2+2	3
PHYCO 6007(7)	Imaging Materials and Processes	2+2	3
PHYCO 6008(7)	Image Processing & Computer Vision	2+2	3
PHYCO 6009(7)	Cyber Forensics	2+2	3

MSc Physics with Specialisation in Astrophysics

PHYAS 6004(7)	Physical Processes in Astrophysics	3+0	3
PHYAS 6006(7)	Multi-wavelength Astrophysical Techniques	2.5+1	3
PHYAS 6007(7)	General Relativity & Physical Cosmology	3+0	3
PHYAS 6008(7)	Pulsar Astronomy	2.5+1	3

MSc Physics with Specialisation in Renewable Energy

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

MSc Physics with Specialisation in Forensic Science

PHYFS 6003(7)	Legal aspects of Forensic science	3+0	3
PHYCO 6009(7)	Cyber Forensics	2 + 2	3
FRSC 1001Y(1)	Introduction to Forensic Science and Crime Scene Investigation	1.5 + 0.5	3
FRSC 2001Y(3)	Methods of Crime Detection I	2.5+1	3
FRSC 2002Y(3)	Methods of Crime Detection II	2.5+1	3
FRSC 3002Y(5)	Forensic Biology and DNA profiling	2.5+1	3
FRSC 3003Y(5)	Drugs of abuse and Forensic Toxicology	2.5+1	3

C. Other Electives

And/or modules approved by the department

10. Programme Plan - BSc (Hons) Physics/MSc Physics/MSc Physics with specialisation

YEAR 1

Code	Module Name	Hrs/Wk L+P	Credits
CORE			
PHYSI 1101(1)	Mathematical Techniques for Physicists I	3+0	3
PHYSI 1201(1)	Mathematical Techniques for Physicists II	3+0	3
PHYSI 1102(1)	Mechanics I	3+0	3
PHYSI 1203(1)	Physics of Matter	3+0	3
PHYSI 1104(1)	Waves & Optics I	3+0	3
PHYSI 1204(1)	Electromagnetism I	3+0	3
PHYSI 1105(1)	Electric Circuits & Electronics	3+0	3
PHYSI 1006Y(3)	Physics Lab I	0+3	3
PHYSI 1107(1)	Thermal Physics	3+0	3
PHYSI 1208(1)	Quantum Physics	3+0	3
PHYSI 1009(1)	Introduction to Astronomy	3+0	3
PHYCO 1100(1)	Operating Systems and Scientific Softwares	2+2	3
PHYCO 1201(1)	Numerical & Scientific Computing I	2+2	3

YEAR 2

Code	Module Name	Hrs/Wk L+P	Credits
CORE			
PHYSI 2101(3)	Maths for Physicists I	3+0	3
PHYSI 2201(3)	Maths for Physicists II	3+0	3
PHYSI 2002(3)	Mechanics II	3+0	3
PHYSI 2104(3)	Electromagnetism II	3+0	3
PHYSI 2203(3)	Optics II	3+0	3
PHYSI 2005(3)	Quantum Mechanics I	3+0	3
PHYSI 2106(3)	Physics Lab. II	0+3	1.5
PHYSI 2206(3)	Experiment Design	0+3	1.5
ELECTIVES			
Departmental			
PHYEL 2007(3)	Electronics & Communications	2+2	3
PHYEL 2010(3)	Computational Physics	2+2	3
Astrophysics			
PHYAS 2008(3)	Astrophysics I	2.5+1	3
PHYAS 2011(3)	Astronomical Techniques I	2+2	3

Instrumentation

PHYIN 2012(3)	Electronics in Instrumentation I	2.5+1	3
PHYIN 2013(3)	Measurement & Sensors	2.5+1	3
PHYIN 2015(3)	Statistical Methods for Physicists	2.5+1	3

Renewable Energy

PHYRE 2016(3)	Renewable Energy Resources I	2.5+1	3
PHYRE 2017(3)	Renewable Energy Resources II	2.5+1	3
PHYRE 2018(3)	Automatic Control and Regulation	2.5+1	3
PHYRE 2019(3)	Climate Dynamics	2.5+1	3

And/or modules approved by the department.

YEAR 3

Code	Module Name	Hrs/Wk L+P	Credits
CORE			
PHYSI 3000Y(5)	Project/Dissertation	–	8
PHYSI 3001(5)	Nuclear Physics	3+0	3
PHYSI 3102(5)	Atomic & Molecular Physics	3+0	3
PHYSI 3003(5)	Elementary Particle Physics	3+0	3
PHYSI 3104(5)	Statistical Physics	3+0	3
PHYSI 3006(5)	Solid State Physics I	3+0	3
ELECTIVES			
Departmental			
PHYEL 3005(5)	Classical Mechanics	3+0	3
PHYEL 3007(5)	Medical Physics	3+0	3
PHYEL 3009(5)	Electromagnetic Theory	3+0	3
Astrophysics			
PHYAS 3008(5)	Astrophysics II	2.5+1	3
PHYAS 3011(5)	Astronomical Techniques II	2+2	3
PHYAS 3012(5)	Extragalactic Astronomy and Cosmology	2.5+1	3
Instrumentation			
PHYIN 3012(5)	Electronics in Instrumentation II	2+2	3
Renewable Energy			
PHYRE 3014(5)	Energy Conservation	2.5+1	3
PHYRE 3015(5)	Energy Systems	2.5+1	3
PHYRE 3016(5)	Physics of the Atmosphere	2.5+1	3

And/or modules approved by the department.

YEAR 4

Code	Module Name	Hrs/Wk L+P	Credits
CORE			
PHYSI 6000Y(7)	Research Project	-	12
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
MSc Physics			
PHYSI 6005(7)	Mechanics	3+0	3
PHYSI 6006(7)	Physics of Fluids	3+0	3
MSc Physics with Specialisation in Computing and Applications			
PHYCO 6001(7)	Fundamentals of Computer Simulations	2+2	3
PHYCO 6002(7)	Advanced Signal Processing	2+2	3
MSc Physics with Specialisation in Astrophysics			
PHYAS 6003(7)	Stellar Astrophysics	3+0	3
PHYAS 6005(7)	Galactic and Extragalactic Astronomy	3+0	3
MSc Physics with Specialisation in Renewable Energy			
PHYRE 6001(7)	Energy Systems and Management	3 + 0	3
PHYRE 6002(7)	Energy for Sustainable Development	3 + 0	3
MSc Physics with Specialisation in Forensic Science			
PHYFS 6001(7)	Ballistic, explosions, fire propagation	2.5+1	3
PHYFS 6002(7)	Vehicle collisions reconstruction	2.5+1	3
ELECTIVES			
MSc Physics			
PHYSI 6007(7)	Solid State Physics II	3+0	3
PHYSI 6008(7)	Microwaves and Materials	3+0	3
PHYSI 6009(7)	Advanced Practicals	0+9	3
PHYSI 6010(7)	Dynamical Systems and Chaos	3+0	3
PHYSI 6011(7)	Artificial Intelligence Tools	3+0	3
PHYSI 6012(7)	Alternative Energy Resources	3+0	3

MSc Physics with Specialisation in Computing and Applications

PHYCO 6003(7)	Computer-Oriented Statistical Physics	2+2	3
PHYCO 6004(7)	Applied Computational Fluid Dynamics	2+2	3
PHYCO 6005(7)	Computational Electromagnetics	2+2	3
PHYCO 6006(7)	Quantum Computation, Communication & Cryptography	2+2	3
PHYCO 6007(7)	Imaging Materials and Processes	2+2	3
PHYCO 6008(7)	Image Processing & Computer Vision	2+2	3
PHYCO 6009(7)	Cyber Forensics	2+2	3

MSc Physics with Specialisation in Astrophysics

PHYAS 6004(7)	Physical Processes in Astrophysics	3+0	3
PHYAS 6006(7)	Multi-wavelength Astrophysical Techniques	2.5+1	3
PHYAS 6007(7)	General Relativity & Physical Cosmology	3+0	3
PHYAS 6008(7)	Pulsar Astronomy	2.5+1	3

MSc Physics with Specialisation in Renewable Energy

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

MSc Physics with Specialisation in Forensic Science

PHYFS 6003(7)	Legal aspects of Forensic science	3+0	3
FRSC 1001Y(1)	Introduction to Forensic Science and Crime Scene Investigation	1.5 + 0.5	3
FRSC 2001Y(3)	Methods of Crime Detection I	2.5+1	3
FRSC 2002Y(3)	Methods of Crime Detection II	2.5+1	3
FRSC 3002Y(5)	Forensic Biology and DNA profiling	2.5+1	3
FRSC 3003Y(5)	Drugs of abuse and Forensic Toxicology	2.5+1	3

And/or other modules approved by the department.

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

Note: Not all electives may be on offer.

IMPORTANT NOTE: The student will be allowed to opt for the BSc (Hons) Physics, BSc (Hons) Physics with Computing, or any other future Physics undergraduate programme, offered by the department after the common first year, subject to the programme being offered by the department.

11. Outline Syllabus

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

PQ: Prerequirement *(must have followed module & sat for exams)*
PR: Prerequisite *(must have attained a minimum of grade D)*
RQ: Must register for the module, or must have followed the module & sat for exams
MR: Minimum Requirement *(Must have the required number of credits)*

PHYSI 1101(1) – MATHEMATICAL TECHNIQUES FOR PHYSICISTS I (PR: A-Level Physics & Maths)
Vector algebra: vector addition, scalar and vector products, triple products. Vector equation: differentiation and integration of vectors. Polar coordinates. Introduction to complex numbers. Calculus of several variables: partial derivatives, scalar and vector fields. Coordinate systems: cylindrical, spherical. Vector Analysis: gradient, divergence and curl. Line and multiple integrals. Green's theorem in the plane, Divergence theorem and Stokes' theorem. Ordinary differential equations: methods of solution for first order differential equations.

PHYSI 1102(1) – MECHANICS I (PR: A-Level Physics & Maths)
Vectors, Statics, Frames of reference, Kinematics, Dynamics & Forces, Newton's laws of motion, Momentum, Conservation laws, Newton's law of gravitation, Oscillatory motion, Resonance.

PHYSI 1104(1) – WAVES & OPTICS I (PR: A-Level Physics & Maths)
Vibrations and Waves; Fundamentals of geometrical optics; Fermat's principle; Corpuscular theory versus Wave theory; Reflection and refraction at plane/curved surfaces; Aberrations; Matrix Method in Optics; Optical instruments.

PHYSI 1105(1) – ELECTRIC CIRCUITS & ELECTRONICS (PR: A-Level Physics & Maths)
Ohm's law and Kirchoff's laws. Basic electrical components. Steady state DC. Linear circuit analysis and Network theorems. Single phase a.c. Circuits. Three-phase AC systems. Semiconductor diodes and circuits. Introduction to BJ Transistors. Boolean algebra. Karnaugh table. Logic gates. Transients.

PHYSI 1006Y(3) – PHYSICS LAB I (PR: A-Level Physics)
Lectures on measurement systems and methods, characteristics and uses of instruments, data analysis and presentation, report writing. Practical training sessions will consist of a variety of experiments closely related to level/year 1 core Physics modules and will cover topics like heat, optics, sound, electricity, mechanics and properties of matter.

PHYSI 1107(1) – THERMAL PHYSICS (PR: A-Level Physics & Maths)
State variables, equilibrium states, PVT surface temperature, Zeroth law of thermodynamics, Thermometers, temperature scales. Thermal expansion, thermal conductivity in solids, Specific heat, phase changes. Laws of thermodynamics. Entropy and the second law. Heat engines and reversible processes. Kinetic theory of gases. Specific heats of gases, Law of equipartition of energy, atomicity. Adiabatic processes, speed of sound in gases. Free energies and Maxwell's relations. Black-body radiation.

PHYSI 1201(1) – MATHEMATICAL TECHNIQUES FOR PHYSICISTS II (PQ: PHYSI 1101(1))
Further differential equations. Further complex numbers. Hyperbolic functions. Limits. Curve sketching. Infinite series: comparison test and ratio test for non-negative series. Introduction to Fourier Series. Matrix Algebra: Matrices, determinants, inverses; solutions of linear systems of equations. Eigenvalues and eigenvectors.

PHYSI 1203(1) – PHYSICS OF MATTER (PR: A-Level Physics & Maths)
States of matter, Interatomic and intermolecular forces, X-ray diffraction and the crystal lattice, Cohesive & Elastic properties, Thermal motion & Boltzmann principle, Thermal properties of crystalline solids and gases, Transport properties. Polarisation in dielectrics, permittivity and dielectric susceptibility. Magnetism in matter: Magnetisation, magnetic susceptibility and permeability. Elements of fluid mechanics. Concepts of fluid flow.

PHYSI 1204(1) – ELECTROMAGNETISM I (PR: A-Level Physics & Maths)
Electrostatics: Coulomb's Law and the electric field; Electric flux and Gauss's Law. Electric potential, and the relationship between field and potential. Capacitors and electrical energy storage. Calculations of the electric field, electric potential and capacitance in simple cases. Magnetostatics: Magnetic fields and forces generated by a conductor; Biot-Savart and Ampere's Laws and applications to calculation of magnetic fields; Forces between currents, torque on a current loop. The magnetic dipole, torque and P.E. in a magnetic field.

PHYSI 1208(1) – QUANTUM PHYSICS (PR: A-Level Physics & Maths)
Some problems of classical physics: black body radiation, photoelectric effect and stability of atoms. Energy quantisation. Particle nature of radiation. Compton effect. Rutherford model of the atom. Bohr model of the hydrogen atom. Wave-particle dualism. The Uncertainty Principle. Introduction to the Schrödinger equation.

PHYSI 1009(1) – INTRODUCTION TO ASTRONOMY
Historical development of Astronomy. Our Solar System: the Sun, Planets, Comets, Asteroids and meteor showers. About stars: brief notion of their nature and life history. Extrasolar planets. The interstellar medium. Nebulous objects. Our Galaxy, its contents and its structure. Other galaxies. The Universe and its expansion. Recent Discoveries in Astronomy.

Practical component: Use of Sky Charts. Naked eye identifications of some constellations, some stars and planets in the night sky. Use of a small optical telescope to view fainter nebulous objects and to observe planets like Jupiter and Saturn in more detail.

PHYSI 2002(3) – MECHANICS II (PQ: PHYSI 1102(1) & PHYSI 1201(1))
Angular momentum. Rigid body mechanics. Inertial and non-inertial frames of reference. Special Relativity.

PHYSI 2005(3) – QUANTUM MECHANICS I (PQ: PHYSI 1208(1))
Development of the Schrödinger wave equation (SWE), Wave functions, Eigenfunctions and eigenvalues, 1-D potentials, Angular momentum, 3-D SWE, Operator methods in quantum mechanics, General structure of wave .

PHYSI 2101(3) – MATHS FOR PHYSICISTS I (PQ: PHYSI 1201(1))
Theory of linear vector spaces: basis vectors, linear operators, matrix representation of linear operators. Inner product spaces. Fourier series, Some equations of mathematical physics, Series solution and some special functions. Applications.

PHYSI 2104(3) – ELECTROMAGNETISM II (PR: A-Level Physics & Maths; PQ: PHYSI 1204(1))
Time varying fields: Magnetic Induction, Faraday's Law and Lenz's Law; generators and alternators. Inductance and energy storage in inductors. Self and mutual inductance. Dielectric permittivity, Magnetic susceptibility, and permeability. Maxwell's equations. The electromagnetic wave equation in lossless or lossy media: Plane waves, effects of boundaries. Energy and momentum of electromagnetic waves - the Poynting theorem. Coaxial lines and wave guides.

PHYSI 2106(3) – PHYSICS LAB II (PR: PHYSI 1006Y(3))
Sessions will consist of a variety of experiments closely related to level/year 1 / level/year 2 Physics modules. Students will be exposed to the use of computers for experiments.

PHYSI 2201(3) – MATHS FOR PHYSICISTS II (PQ: PHYSI 2101(3))
Complex variable theory, Calculus of residues. Dirac delta function, Fourier and Laplace Transforms, Parseval's Theorem, Convolution Theorem, applications.

PHYSI 2203(3) – OPTICS II (PR: A-Level Physics & Maths; PQ: PHYSI 1104(1))
Nature of light. Wave motion and wave superposition. Electromagnetic waves. Polarisation. Interference and Interferometry. Diffraction and diffraction gratings. Introduction to lasers. Introduction to optical fibres.

PHYSI 2206(3) – EXPERIMENT DESIGN (PR: PHYSI 1006Y(3))
Mini-project on experiment design and testing in physics.

PHYSI 3000Y(5) – PROJECT (MR: 39 CREDITS IN YEAR I AND YEAR II CORE MODULES COMBINED)
Project work on a topic approved by the Department.

PHYSI 3102(5) – ATOMIC & MOLECULAR PHYSICS (PQ: PHYSI 2005(3))
Review of Bohr's theory - observations in support of the theory, its limitations. QM approach for spinless one-electron atoms. The Stern Gerlach Experiment - Space quantisation and the electron spin. Spin effects in one electron atoms. Many electron atoms. The periodic table. The Zeeman Effect. Molecular Spectra.

PHYSI 3001(5) – NUCLEAR PHYSICS (PQ: PHYSI 2005(3))
Nuclear structure and size. Binding energy and semi-empirical mass formula. Nuclear forces and nuclear models. Radioactivity (natural and artificial). Fission and fusion. Theories of alpha, beta and gamma decay. Nuclear reactions. Fission and fusion reactors. Controlled fusion. Fusion processes inside stars.

PHYSI 3003(5) – ELEMENTARY PARTICLE PHYSICS (PQ: PHYSI 2005(3))
The standard model. Leptons, quarks, hadrons and gauge bosons. Strong, Electromagnetic and Weak interactions and transmission. Particle properties and quantum numbers. Conservation laws in particle physics. Introduction to Feynman diagrams.

PHYSI 3104(5) – STATISTICAL PHYSICS (PR: PHYSI 1107(1))
Entropy and its relation to microscopic properties of a system. Basic methods of Statistical Mechanics – concept of Statistical ensembles. Microcanonical and canonical ensembles and their application for discrete systems. Classical systems: the Equipartition theorem, Ideal Classical gas. Introduction to Quantum Statistical Mechanics.

PHYSI 3006(5) – SOLID STATE PHYSICS I (PQ: PHYSI 2005(3))
Crystal diffraction and the reciprocal lattice, Lattice vibrations, Thermal properties, Free electron Fermi gas, Band theory, Semi-conductors, Fermi surfaces.

PHYCO 1100(1) – OPERATING SYSTEMS & SCIENTIFIC SOFTWARES
Introduction to Windows, and Internet. Use of office softwares for document processsing and spreadsheets. GNU, Graphic User Interfaces with Linux: KDE, Gnome, X-Window, Shells, File systems, Processes, I/O redirection, Editors, Home directory. Introduction to Lateχ and free scientific softwares.

PHYCO 1201(1) – NUMERICAL & SCIENTIFIC COMPUTING I (PR: A-Level Physics & Maths)
Fundamentals of C/Fortran programming. Interpolation. Numerical integration and differentiation. Applications to physical systems.

PHYEL 2007(3) – ELECTRONICS & COMMUNICATIONS (PQ: PHYSI 1105(1))
Field Effect Transistors, Transistor circuits, Operational Amplifiers/Analogue to Digital Conversion and Digital to Analogue Conversion/Combinational circuits, Sequential circuits, Flip Flops, Registers, Counters, Serial and parallel data transfer. Communication theory – Analogue Modulation Schemes - AM and FM - Signal detection and demodulation. Digital modulation schemes. Noise.

PHYEL 2010(3) – COMPUTATIONAL PHYSICS (PQ: PHYSI 1201(1) & PHYCO 1100(1))
Phase space, computational aspects of phase space diagrams, spectral methods of analysis, Optimisation procedures, simulation methods, Applications to physical systems.

PHYEL 3005(5) – CLASSICAL MECHANICS (PQ: PHYSI 2002(3))
Lagrangian formulation, Applications to physical examples, Hamiltonian formulation, Variational principles, Phase space, Poisson Brackets, Transition to quantum mechanics, Introduction to Hamilton-Jacobi equations.

PHYEL 3007(5) – MEDICAL PHYSICS (PR: A-Level Physics)
Aspects of dosimetry, nuclear medicine, radiotherapy, medical instrumentation, ultrasound, magnetic resonance imaging and radiology.

PHYEL 3009(5) – ELECTROMAGNETIC THEORY (PR: PHYSI 2201(3); PQ: PHYSI 2104(3) & PHYSI 2002(3))
Special relativity; Lorentz transformation; Lorentz scalars, vectors and tensors. Maxwell equations recast in relativistically covariant form; Electromagnetic field tensor; transformation laws for the electric and

magnetic fields; invariants; Lienard-Wiechert potentials Lorentz force; Energy-momentum tensor; Radiation from accelerating charges.

PHYAS 2008(3) – ASTROPHYSICS I (PR: A-Level Physics & Maths & PHYSI 1009(1))
Our Solar System: Formation theories, Terrestrial and Outer planets, Planetary Motion. Stellar observational data: Stellar brightnesses, magnitude systems, stellar parallax and determination of stellar distances. Luminosities, effective temperatures and radii of stars. Binary stars and determination of stellar masses. Stellar spectra. Spectral Classification of Stars. Colour-magnitude diagrams. Stellar interiors: Hydrostatic equilibrium, composition, pressure and temperature inside stars. Energy generation and energy transport inside stars.

PHYAS 2011(3) – ASTRONOMICAL TECHNIQUES I (PR: A-Level Physics & Maths)
Introduction to observational techniques used for different astronomical windows. Optical Astronomy - optical telescopes and their accessories. Astronomy at other wavelengths. The Celestial Sphere, Spherical trigonometry and Coordinate systems used in astronomy. Time Keeping Systems for Astronomical purposes and civil life. Applications to the Sun and other astronomical objects.

PHYAS 3008(5) – ASTROPHYSICS II (PR: PHYAS 2008(3))
The Sun as a star, Solar activity and Space Weather. Stellar Observational Data, including observed Colour-Magnitude diagrams. Formation and evolution of stars and their relation to the interstellar medium. Stellar Clusters. Colour magnitude diagrams of stellar clusters. Determination of age of Star Clusters. Stellar populations. The end-states of stars (degenerate stars such as White Dwarfs and Neutron stars and associated objects like Planetary Nebulae and Supernova Remnants). Observations of Neutron stars as Pulsars. Observational Characteristics of Pulsars and Pulsar Models. Overview of Galactic & extra-galactic astronomy.

PHYAS 3011(5) – ASTRONOMICAL TECHNIQUES II (PR: PHYAS 2011(3))
Radioastronomy fundamentals. Basic concepts behind the design of radio telescopes (from single dish antennas to antenna arrays and Aperture Synthesis) and how they are used for imaging. Practical Applications.

PHYAS 3012(5) – EXTRAGALACTIC ASTRONOMY AND COSMOLOGY (PR: PHYAS 3008(5))
Normal Galaxies. Active Galactic Nuclei (AGNs). Classification of Extragalactic Radio Sources. Formation and Evolution of Normal Galaxies. Formation and Evolution of AGNs. Clusters and Superclusters of Galaxies. Large Scale Structure of the Universe. Dark Matter. Dark Energy. Introduction to Cosmological Models.

PHYIN 2012(3) – ELECTRONICS IN INSTRUMENTATION I (PQ: PHYSI 1105(1))
Components of a measurement system - Power Supplies - Amplifiers - Operational Amplifiers and Instrumentation Operational Amplifiers - Noise, Noise Temperature, Signal to Noise Ratio – Filtering, Active and Passive Filters – Sampling - Analog to Digital conversion and ADC circuits, Digital to analog conversion.

PHYIN 2013(3) – MEASUREMENT & SENSORS (PQ: A-Level Physics & Maths)
Aims and Principles of measurement. Standards of measurements. Instrument characteristics. Electrical measurements. Introduction to signal conditioning. Instrument calibration. Quality control and management. Standard reference materials. Method validation. Common transducers. Typical measurement systems: sensing, signal conditioning, signal processing, data transmission and recording. Control. Interference and screening. Data acquisition, Sensors.

PHYIN 2015(3) – STATISTICAL METHODS FOR PHYSICISTS (PQ: A-Level Physics & Maths)
Elementary probability theory; Random variables and probability distributions; Descriptive statistics; Statistical treatment of data; Sampling theory and strategies; Data presentation and analysis.

PHYIN 3012(5) – ELECTRONICS IN INSTRUMENTATION II (PQ: PHYIN 2012(3))
Microcontrollers - Harvard and Von-Neumann Architectures - CISC and RISC processors – Clock – CPU – Ports – Memory– Registers – Memory – Interrupts- Timers – ADC – UART - Assembly Language – Compiled language – Applications based on the PIC microcontroller. Introduction to Digital Signal

Processing- Transforms – Digital filtering - Spectral Analysis – Convolution Deconvolution - Applications built around the DSPIC Chip.

PHYRE 2016(3) – RENEWABLE ENERGY RESOURCES I
Fuels and energy. World energy demand: present and future. Fossil energy reserves. Nuclear power. Carbon dioxide emissions and climate change. Nuclear waste. Renewable energy, its availability and usage. The price of energy: a historical perspective. Economics of renewable energy power projects. Solar energy. Solar heating and photovoltaics Wind power. Utilization of wind energy. Wind turbine design and operation.

PHYRE 2017(3) – RENEWABLE ENERGY RESOURCES II
Hydro-electric power. Biofuels. Wave energy. Tidal power. Ocean thermal energy conversion. Geothermal energy. Hydrogen Fuel cells. Energy Storage materials. Inverters. Off-grid and grid-tie systems.

PHYRE 2018(3) – AUTOMATIC CONTROL AND REGULATION
Dynamic systems. Differential equation models. Transfer functions. Analysis of feedback control systems: Stability. Root-locus. Nyquist and Bode diagrams. Accuracy. Speed of response. Robustness and sensitivity. Synthesis of simple control systems: Specifications. PID-controllers. Lead-lag compensation. State space models. State feedback. Pole placement. Observers. Digitally implemented controllers.

PHYRE 2019(3) – CLIMATE DYNAMICS (PQ: A-Level Physics)
Past climate and gases, aerosol and radiation. Green house gas cycle, and dynamics of the atmosphere and the oceans. The role of the atmosphere in climate. Ocean circulation. Interannual Fluctuations of the Walker-Circulation – ENSO. Interaction of the Atmosphere, oceans and Biosphere. Regional effects of Climate change. Unresolved problems in climate analysis.

PHYRE 3014(5) – ENERGY CONSERVATION
Heat transfer in buildings. Comfort. Passive heating & cooling. Ventilation & Air Conditioning. Heat recovery. Cogeneration. Energy saving appliances. Analysis of sustainable buildings. Energy storage technology. Transportation.

PHYRE 3015(5) – ENERGY SYSTEMS
Residential & Commercial systems connected to the electric grid. Components of grid-tie systems. Operation. Safety. Fuel Cells. Clean coal systems. Waste heat utilization. Pyrolysis and Gasification Research.

PHYRE 3016(5) – PHYSICS OF THE ATMOSPHERE (PQ: PHYSI 1102(1) & PHYSI 1201(1))
Simple energy balance climate models. Effect of transport on composition. 'Statics' of a rotating system. Observed atmospheric structures. Equations of motion. Symmetric circulation models. Internal Gravity Waves: Basics. Rossby waves. Vorticity and quasi-geostrophy. The generation of eddies by instability. Tropical meteorology. Numerical models.

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**.**

PHYSI 6005(7) – MECHANICS
A brief survey of the basic principles. Variational principles and Lagrange's equations. Central conservative forces. Kinematics of rigid bodies. Dynamics of a rigid body. Hamilton's equations of motion. Canonical transformations. Hamilton-Jacobi equation. Relativistic mechanics.

PHYSI 6006(7) – PHYSICS OF FLUIDS
Fluid statics. Fluid motion. Boundary layer flow. Flow in open channels. Flow in pipes and ducts. Incompressible & compressible flows. Turbulence. Non-Newtonian fluids. Hydraulic machines. Applications.

PHYSI 6007(7) – SOLID STATE PHYSICS II
Review: The free electron model and its failures. Electrons in periodic potentials. Band model. Approximate methods of band structure calculations. Lattice dynamics. Accurate methods of band structure calculations. Beyond the independent electron approximation. Many-body theory (an introduction). Magnetism in solids. Advanced theories of dielectric solids. Elementary excitations. Superconductivity. Quantum Hall effect.

PHYSI 6008(7) – MICROWAVES AND MATERIALS
Dielectrics. Polarisation in dielectrics. Dielectric losses. Relaxation models. Permittivity tensor. Magnetic permeability. Magnetic losses. Ferrites. Permeability tensor. Faraday rotation. Transmission lines. Propagation constant and attenuation constant. Characteristic impedance. Smith chart. Field analysis of waveguides. Propagation modes. Rectangular circular and coaxial guides. Waveguide discontinuities. Scattering matrix theory. Passive components.

PHYSI 6009(7) – ADVANCED PRACTICALS
This module aims at developing and enhancing experimental expertise. The practicals will be based on the various fields of physics.

PHYSI 6010(7) – DYNAMICAL SYSTEMS AND CHAOS
Phase space description of dynamical systems. Critical points in phase space. Non-linear deterministic systems. Chaos. Routes to chaos. Strange attractors. Poincaré maps. Characterisation of strange attractors. Applications to physical systems.

PHYSI 6011(7) – ARTIFICIAL INTELLIGENCE TOOLS
Fuzzy set: Theory and applications. Fuzzy systems. Neural network. Supervised and unsupervised learning architectures. Genetic algorithm and evolutionary computing.

PHYSI 6012(7) – ALTERNATIVE ENERGY RESOURCES
Brief review of the different sources of renewable energy and types of collectors. Solar energy. Wind energy. Tidal energy. Wave energy. Geo-thermal energy. Brief review of some other sources. Applications.

PHYCO 6001(7) – FUNDAMENTALS OF COMPUTER SIMULATIONS
Importance of computer simulations in Physics. Review of basic numerical tools for solving problems in Physics: Solution of differential equations, matrix operations & eigenvalue problems, interpolation and numerical integration, modelling of data and Monte Carlo methods. Python Programming. Data storage, processing and visualization using Matlab. Model enhancement using high performance scientific computing.

PHYCO 6002(7) – ADVANCED SIGNAL PROCESSING
Analogue and digital signals. Noise. Filtering. Sampling (Nyquist theorem). Digitisation. Correlation. Transforms. Convolution & Deconvolution techniques. Spectral analysis. Component analysis. Applications.

PHYCO 6003(7) – COMPUTER-ORIENTED STATISTICAL PHYSICS
Review of Thermodynamics and Statistical mechanics. Equilibrium Monte Carlo Simulations: Ising Model, Metropolis, Glauber and Kawasaky algorithms. Non-equilibrium Monte-Carlo simulations: directed

percolation and kinetically constrained models. Off-Lattice Simulations: cluster algorithm and molecular dynamics. Langevin and KPZ Dynamics.

PHYCO 6004(7) – APPLIED COMPUTATIONAL FLUID DYNAMICS
Fluid mechanics: Concept of continuum, streamlines, streaklines and pathlines, Buoyancy, Lagrangian and Eulerian descriptions, conservation equations. Fundamentals of Finite Difference, Finite Volume and Finite Element Methods. The SIMPLE scheme. Turbulence modelling. Application to some classical problems.

PHYCO 6005(7) – COMPUTATIONAL ELECTROMAGNETICS
Review of Electromagnetic fields and waves: Maxwell's equations, wave equations and wave propagation. Theory and use of finite-difference time-domain method; Yee algorithm; numerical dispersion; absorbing boundary conditions; Incident Wave Source Conditions for Free Space and Waveguides; scattering; radiation; time domain vs. frequency domain. Near to far field transformation. Applications.

PHYCO 6006(7) – QUANTUM COMPUTATION, COMMUNICATION & CRYPTOGRAPHY
Basic principles of quantum mechanics. Quantum gates and circuits. Classical computation versus quantum computation. Entanglement. Quantum algorithms: Shor's factoring and discrete logarithm; Grover's search; simulation. Classical and quantum information theory, quantum cryptography, teleportation, dense coding. Error correction and fault-tolerant quantum computing. Physical realizations: nuclear magnetic resonance; ions in traps; solid state devices.

PHYCO 6007(7) – IMAGING MATERIALS AND PROCESSES
Images & imaging. Colour & photography. Imaging materials & systems. Scanning. Digitisation. Compression. Transmission. Recording. Storage. Stability & preservation. Applications.

PHYCO 6008(7) – IMAGE PROCESSING & COMPUTER VISION
Imaging and image representation. Image fundamentals. Transformations and operations. Noise. Component analysis. Image analysis. Shape analysis and object recognition. Image filtering and enhancement. Segmentation. Matching. Image sequences. Image databases. Perceiving 3D from 2D images. Virtual reality. Applications.

PHYCO 6009(7) – CYBER FORENSICS
Overview of cyber forensics, Computer concepts (hardware and software), Networks, Computer and network forensics, Ethical and legal issues.

PHYAS 6003(7) – STELLAR ASTROPHYSICS
Colour magnitude diagrams. Effective temperatures of stars. Masses and radii of stars and their determination. Our Sun. Spectral classification. Population I and II stars. Stellar structure and evolution. Stellar magnetic fields. Pulsating stars. Explosive stars. Interstellar medium.

PHYAS 6005(7) – GALACTIC AND EXTRAGALACTIC ASTRONOMY
Stellar evolution in Galaxies. Morphology of galaxies. The Milky Way as a Galaxy. Structure of the Galaxy. Kinematics of the Galaxy. Scaling relations. Luminosity function of Galaxies. Galaxies as Gravitational lenses. Population synthesis. Nucleosynthesis and Chemical Evolution of Galaxies. Galaxy formation and evolution. Active Galactic Nuclei (AGNs). Clusters of galaxies. The Dark Matter problem. Candidates for dark matter.

PHYAS 6004(7) – PHYSICAL PROCESSES IN ASTROPHYSICS
Fundamentals of radiative transfer. Different types of astrophysical processes occurring in the universe, like synchrotron radiation, thermal absorption, synchrotron self-absorption, Bremsstrahlung, Compton scattering. Plasma effects. Spectra of radio sources. Atomic structure. Molecular structure.

PHYAS 6006(7) – MULTIWAVELENGTH ASTROPHYSICAL TECHNIQUES
Brief historical development of observational astronomy. Transparency of the Earth's atmosphere and ionosphere to EM waves. Observational techniques used for different parts of the EM spectrum (Optical & Infrared, Radio & microwave, X-ray & Gamma-ray). Virtual observatories and Data Mining. Introduction to multiwavelength analysis. Other astronomical windows. Coordinate systems used in astronomy and their applications.

PHYAS 6007(7) – GENERAL RELATIVITY AND PHYSICAL COSMOLOGY
Brief review of Special Relativity. Introduction to General Relativity. General tensor calculus. Riemannian space. The General Theory of Relativity. Some predictions and tests of General Relativity. Standard Cosmology. Thermal history of the Universe. The Microwave Background Radiation. X-ray emission from Clusters of Galaxies. Gravitational lensing. Sunyaev-Zeldovich effect. Inhomogeneities in the Universe. Cosmological parameters. The Universe at High Redshift.

PHYAS 6008(7) – PULSAR ASTRONOMY
Star deaths and the formation of compact objects. Neutron star models. Observational properties of Pulsars. Pulsar emission mechanisms. Observational techniques in Pulsar Astronomy. Pulsar data processing and analysis.

PHYFS 6001(7) – BALLISTICS, EXPLOSIONS, FIRES
Firearms. Flight of bullets. Propelled flight of missiles. Distance of firing. Physics of explosions. Explosion modelling. Fire propagation and analysis

PHYFS 6002(7) – VEHICLE COLLISIONS RECONSTRUCTION
Mechanics. Friction and braking. Driving hazards. Accident dynamics. Collision modelling and reconstruction.

PHYFS 6003(7) – LEGAL ASPECTS OF FORENSIC SCIENCE
Mauritian legal framework. Jurisdiction of our courts. Laws of evidence and admissible evidence. Opinion and Expert evidence. Role of forensic science. Accident and Crime scene investigation.

FRSC 1001Y(1) – INTRODUCTION TO FORENSIC SCIENCE AND CRIME SCENE INVESTIGATION
Historical developments of forensic science, role of forensic science, introduction to crime scene investigation, crime scene preservation, and documentation, an overview of crime scene processing, identifying and labelling of exhibits, recovery and packaging of physical evidences, continuity and integrity, quality assurance in laboratories.

FRSC 2001Y(3) – METHODS OF CRIME DETECTION I
Comparison, analysis and identification of fingerprints, footwear impressions and tool marks. Questioned documents and document analysis, analysis of paint, ink and glass.

FRSC 2002Y(3) – METHODS OF CRIME DETECTION II
Blood and blood pattern analysis, characterisation and comparison of hair and other fibres, firearms (cartridge cases, bullets, safety mechanisms, firing distance and gunshot residue)

FRSC 3002Y(5) – FORENSIC BIOLOGY AND DNA PROFILING
Examination of body fluids (blood, semen, saliva), Forensic DNA analysis and DNA profiling, forensic anthropology, the role and use of entomology in post mortem and/or any other topics.

FRSC 3003Y(5) – DRUGS OF ABUSE AND FORENSIC TOXICOLOGY
Drugs legislation, methods of detection and identification of drugs and poisons, toxological principles and interpretation of toxological data.

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. CO_2 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

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
Types of 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 monophase AC Circuits. Power and power factor. Polyphase AC. Balanced three-phase circuits. Per phase analysis. Complex Power measurements. Ideal monophase 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.

14 September 2012