

DIPLOMA IN INDUSTRIAL PHYSICS

Qualification code: D3IP13 - NQF Level 6 (360 credits)

SAQA ID: 88122, CHE NUMBER: H/H16/E015CAN

Campus where offered: Arcadia Campus

REMARKS

a. *Admission requirement(s) and selection criteria:*

• **FOR APPLICANTS WHO OBTAINED A SENIOR CERTIFICATE BEFORE 2008:**

Admission requirement(s):

A Senior Certificate or an equivalent qualification with an E symbol (40-49%) at Higher Grade or a D symbol (50-59%) at Standard Grade for English, Physical Science and Mathematics.

Selection criteria:

To be considered for this qualification, applicants must have an Admission Point Score (APS) of at least 21 (six subjects).

Formula for determination of APS:

| SYMBOL | HG VALUE | SG VALUE |
|--------|----------|----------|
| A | 8 | 7 |
| B | 7 | 6 |
| C | 6 | 5 |
| D | 5 | 4 |
| E | 4 | 2 |

• **FOR APPLICANTS WHO OBTAINED A NATIONAL SENIOR CERTIFICATE IN OR AFTER 2008:**

Admission requirement(s):

A National Senior Certificate with a bachelor's degree or a diploma endorsement, or an equivalent qualification, with an achievement level of at least 4 for English (home language or first additional language), 4 for Mathematics and 4 for Physical Sciences.

Selection criteria:

To be considered for this qualification, applicants must have an Admission Point Score (APS) of at least 21.

Assessment procedures:

Applicants with a final APS of 24 and more will be considered for admission. Applicants with a score of 21 to 23 will be invited to write an academic proficiency test. The APS will contribute 80% to the final admission score and the academic proficiency test 20%.

b. *Minimum duration:*

Three years.

c. *Presentation:*

Day classes.

d. *Intake for the qualification:*

January only.

e. *Exclusion and readmission:*

See Chapter 2 of Students' Rules and Regulations.



- f. *Recognition of Prior Learning (RPL), equivalence and status:*
See Chapter 30 of Students' Rules and Regulations.
- g. *Work-Integrated Learning I:*
See Chapter 5 of Students' Rules and Regulations.
- h. *Textbooks:*
Textbooks and other educational material will be required.
- i. *Module credits:*
Module credits are shown in brackets after each module.

Key to asterisks:

- * Information does not correspond to information on AA72.
(Deviations approved by the Senate in June 2015 and September 2015.)

CURRICULUM

FIRST YEAR

| CODE | MODULE | NQF-L | CREDIT | PREREQUISITE MODULE(S) |
|---------|----------------------|-------|--------|------------------------|
| GLCH500 | General Chemistry IA | (5) | (27) | |
| GLPH500 | General Physics IA | (5) | (27) | |
| MATH500 | Mathematics I | (5) | (20) | |

FIRST SEMESTER

| | | | | |
|---------|------------------------|-----|------|--|
| COSH501 | Communication Skills I | (5) | (9) | |
| ENDH501 | Engineering Drawing I | (5) | (15) | |
| LSKH501 | Life Skills | (5) | (2) | |

SECOND SEMESTER

| | | | | |
|---------|----------------------|-----|------|--|
| CSKH501 | Computer Skills I | (5) | (10) | |
| ISPH501 | Industrial Physics I | (5) | (10) | |

TOTAL CREDITS FOR THE FIRST YEAR: **120**

SECOND YEAR

| CODE | MODULE | NQF-L | CREDIT | PREREQUISITE MODULE(S) |
|---------|-----------------------|-------|--------|---|
| ISPH600 | Industrial Physics II | (6) | (30) | General Physics IA Industrial Physics I Mathematics I |
| MATH600 | Mathematics II | (6) | (20) | General Physics IA Mathematics I |
| MTSH500 | Material Science I | (5) | (20) | General Chemistry IA General Physics IA |

One of the following electives:

| | | | | |
|---------|----------------------|-----|------|---|
| NCTH500 | Nuclear Technology I | (5) | (25) | General Chemistry IA General Physics IA Industrial Physics I Mathematics I |
| PTNH500 | Photonics I | (5) | (25) | General Chemistry IA General Physics IA Industrial Physics I Mathematics I |



FIRST SEMESTER

| | | | | |
|---------|------------------------|-----|------|--|
| CPPH501 | Computer Programming I | (5) | (15) | Computer Skills I General Physics IA Mathematics I |
|---------|------------------------|-----|------|--|

SECOND SEMESTER

| | | | | |
|---------|--------------------------|-----|------|--------------------|
| ELPH501 | Electronics Principles I | (5) | (10) | General Physics IA |
|---------|--------------------------|-----|------|--------------------|

TOTAL CREDITS FOR THE SECOND YEAR: **120**

THIRD YEAR

| CODE | MODULE | NQF-L | CREDIT | PREREQUISITE MODULE(S) |
|------|--------|-------|--------|------------------------|
|------|--------|-------|--------|------------------------|

FIRST SEMESTER

| | | | | |
|---------|------------------------|------|------|-------------------------------------|
| ISP306R | Industrial Physics III | (6)* | (20) | Industrial Physics II |
| MTLH501 | Metrology I | (5) | (10) | General Physics IA Mathematics I |
| MTSH601 | Material Science II | (6) | (15) | Material Science I |

One of the following electives:

| | | | | |
|---------|-----------------------|-----|------|----------------------|
| NCTH601 | Nuclear Technology II | (6) | (15) | Nuclear Technology I |
| PTNH601 | Photonics II | (6) | (15) | Photonics I |

SECOND SEMESTER

| | | | | |
|---------|-----------------------------|-----|------|---------------------------------------|
| EXPH601 | Work-Integrated Learning I* | (6) | (60) | Photonics II or Nuclear Technology II |
|---------|-----------------------------|-----|------|---------------------------------------|

TOTAL CREDITS FOR THE THIRD YEAR: **120**

TOTAL CREDITS FOR THE QUALIFICATION: **360**

SUBJECT/MODULE INFORMATION (OVERVIEW OF SYLLABUS)

The syllabus content is subject to change to accommodate industry changes. Please note that a more detailed syllabus is available at the Department or in the study guide that is applicable to a particular subject/module. On 01 August 2017, the syllabus content was defined as follows:

C

COMMUNICATION SKILLS I (COSH501)

CONTINUOUS ASSESSMENT

(Module custodian: Department of Applied Languages)

Communication theory. Verbal communication. Interviews. Developing leadership and participation skills. Technical writing skills. Group communication skills. Applied technical writing skills. (Total tuition time: ± 40 hours)

COMPUTER PROGRAMMING I (CPPH501)

1 X 3-HOUR PAPER

(Module custodian: Department of Computer Science)

This subject accommodates students from a broad spectrum of disciplines and interests. It includes a theoretical as well as a practical component. This module provides an overview coverage of introductory C++ programming. This is a career-focused information and communication technology qualification that will enable a graduate to design and create ICT software solutions using basic object-orientated concepts and technologies. Basic C++ programs, classes, problem solving, OOP, methods, data manipulation, arithmetic operations, decision structures, loop structures, functions. (Total tuition time: ± 120 hours)



COMPUTER SKILLS I (CSKH501)**CONTINUOUS ASSESSMENT***(Subject/Module custodian: End User Computing Unit)*

Students have to acquire theoretical knowledge (computing fundamentals) and practical skills as an end-user in operating systems and MS Office Suite applications (MS Word, MS Excel and MS PowerPoint) on an introductory level. Students will do online and computer based tests. The modules are mapped with SAQA and IC3 Essential Skills for Digital Literacy (international certification). (Total tuition time: ± 40 hours)

E**ELECTRONICS PRINCIPLES I (ELPH501)****1 X 3-HOUR PAPER***(Module custodian: Department of Physics)*

Electronic components, measuring instruments, semi-conductor physics, P-N junction diode, laser diodes, bi-polar junction transistor (BJT), multi-stage amplifiers, field-effect transistor (FET), operational amplifier (Op-Amp), sensors and transducers: temperature measurement. (Total tuition time: ± 40 hours)

ENGINEERING DRAWING I (ENDH501)**CONTINUOUS ASSESSMENT***(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)*

Drawing office practice. Introduction to draughtmanship, projections (orthographic and isometric), intersections of surface, graphic determination of forces in frames, topographical drawing, SBS specification. (Total tuition time: ± 60 hours)

G**GENERAL CHEMISTRY IA (GLCH500)****1 X 3-HOUR PAPER***(Module custodian: Department of Chemistry)*

Fundamental concepts of matter and scientific measurements, mass relationships in chemical reaction, reactions in aqueous solutions, electronic structure of atoms, basic concepts in chemical bonding, principles of chemical equilibrium, acids and base equilibria, solubility equilibria, oxidation-reduction reactions, electrochemical cells, chemistry of carbon, classification of hydrocarbons, nomenclature of hydrocarbons. Chemistry practical based on theory with emphasis on basic laboratory techniques. (Total tuition time: ± 220 hours)

GENERAL PHYSICS IA (GLPH500)**1 X 3-HOUR PAPER***(Module custodian: Department of Physics)*

Basic mathematics for physics. Introduction to calculus-based physics. Measurements. Kinematics in 1D and 2D. Newton's laws of motion. Dynamics of uniform circular motion. Work energy and power. Impulse and momentum. Rotational kinematics and dynamics. Fluids, temperature and heat. The ideal gas law and kinetic theory. Electric forces and fields. Electric potential energy and the electric potential. Electric circuits. Reflection of light: mirrors, lenses and optical instruments. Practical experiments related to the theory with emphasis on measuring physical quantities. (Total tuition time: ± 160 hours)

I**INDUSTRIAL PHYSICS I (ISPH501)****CONTINUOUS ASSESSMENT***(Module custodian: Department of Physics)*

Safety issues in industry. Physics and technology; basic physical principles that govern industrial technology output; work ethics and industrial working conditions. Writing scientific reports. (Total tuition time: ± 60 hours)

INDUSTRIAL PHYSICS II (ISPH600)**1 X 3-HOUR PAPER***(Module custodian: Department of Physics)*

Introduction to quantum physics and atomic physics. Nuclear structure, binding energy, models, radioactivity, the decay processes, natural radioactivity, nuclear reactions, nuclear magnetic resonance and magnetic resonance imaging. Applications of nuclear physics (fission, fusion, radiation damage, radiation detectors, uses of radiation). Vacuum technology: vacuum fundamentals, production of vacuum, measurement of vacuum (gauges), sealing techniques in vacuum. Non-destructive testing (NDT), definitions and symbols, visual testing (VT), eddy current testing (ET), liquid penetrant testing (PT) of materials, ultrasonic testing of materials. (Total tuition time: ± 160 hours)



INDUSTRIAL PHYSICS III (ISP306R)**1 X 3-HOUR PAPER****(Module custodian: Department of Physics)**

Industrial ventilation: health effects of major indoor air contaminants, ventilation systems, basic testing equipment. Measurements. Vacuum technology: materials in vacuum leak detection, vacuum systems. Non-destructive testing: ultrasonic testing (UT) of materials, magnetic particle testing of materials, radiographic testing of materials. (Total tuition time: ± 90 hours)

L**LIFE SKILLS (LSKH501)****CONTINUOUS ASSESSMENT****(Module custodian: Directorate of Student Development and Support)**

Academic and emotional intelligence and teamwork skills development for students in higher education. Themes: effective learning, effective living, effective teamwork. (Total tuition time: ± 36 hours)

M**MATERIAL SCIENCE I (MTSH500)****1 X 3-HOUR PAPER****(Module custodian: Department of Physics)**

Introduction to materials: atomic structure, atomic and ionic arrangements. Defects in solids. Magnetic properties of materials. Crystalline and polycrystalline material; thermal properties of materials. (Total tuition time: ± 120 hours)

MATERIAL SCIENCE II (MTSH601)**1 X 3-HOUR PAPER****(Module custodian: Department of Physics)**

Diffusion in materials, mechanical properties, optical properties of materials, amorphous materials, deformation and strengthening mechanism, solid solutions and phase equilibrium, corrosion and degradation of materials. (Total tuition time: ± 60 hours)

MATHEMATICS I (MATH500)**1 X 3-HOUR PAPER****(Subject custodian: Department of Mathematics and Statistics)**

Basic mathematics. Differentiation. Integration. Matrices. (Total tuition time: ± 190 hours)

MATHEMATICS II (MATH600)**1 X 3-HOUR PAPER****(Subject/Module custodian: Department of Mathematics and Statistics)**

Differentiation: logarithmic differentiation, implicit functions, the inverse trigonometric functions, the hyperbolic functions, parametric functions, applications. Partial differentiation: first-order partial derivatives, small increments, rates of change, changing of the variables, errors. Integration: fundamental integration formulae, factor integration, partial fractions, hyperbolic functions, standard forms, applications. First-order differential equations: introduction and definitions, direct integration, separation of variables, exact equations, linear equations, Bernoulli's equation, applications. (Total tuition time: ± 120 hours)

METROLOGY I (MTLH501)**1 X 3-HOUR PAPER****(Module custodian: Department of Physics)**

Standards and standardisation. Components in measuring systems. Measurement in Practice. Calibration of laboratory equipment. Radiometric laboratory. Photometric laboratory. Colorimetric laboratory. Fibre-optic laboratory. Typical equipment and application. (Total tuition time: ± 60 hours)

N**NUCLEAR TECHNOLOGY I (NCTH500)****1 X 3-HOUR PAPER****(Module custodian: Department of Physics)**

Origin of penetrating radiation, radiation dosimetry, biological effects of radiation, nuclear physics instrumentation, external radiation protection, internal radiation protection, nuclear reactor physics, nonionizing radiation, radiation protection guides, evaluation of protection measures, radiation protection management, radioactive waste management, transport of radioactive material. (Total tuition time: ± 160 hours)

NUCLEAR TECHNOLOGY II (NCTH601)**1 X 3-HOUR PAPER****(Module custodian: Department of Physics)**

Nuclear reactor physics. Nuclear knowledge management, environmental monitoring, surveillance and dose assessment. Inspections and authorisations. Decommissioning of nuclear facilities. Radiation detection and monitoring equipment. Particle accelerators and applications. Radiation protection in medical applications. (Total tuition time: ± 90 hours)



P**PHOTONICS I (PTNH500)****1 X 3-HOUR PAPER***(Module custodian: Department of Physics)*

Photonics Safety. Polarization of light. Absorption and scattering of light. Basics of laser operation theory. Laser systems. Principles of fibre optics. Thin film coating. (Total tuition time: \pm 160 hours)

PHOTONICS II (PTNH601)**1 X 3-HOUR PAPER***(Module custodian: Department of Physics)*

Solid-state lasers. Frequency multiplication of laser beams. Manufacturing photonics components and semi-conductor elements. Optical systems. (Total tuition time: \pm 90 hours)

W**WORK-INTEGRATED LEARNING I (EXPH601)****WORK-INTEGRATED LEARNING***(Module custodian: Department of Physics)*

Observing industrial working conditions. Safety measures at work and reports on work. Sample preparation. Principles of operating various kinds of equipment. Taking measurements and readings on working samples. Using industrial Geiger Muller radiation counter. Procedures and measurements in film coating on lenses. Industrial vacuum creating: pumps and gauges. Safe handling of radioactive sources; application of various industrial lasers. Monitoring of radioactive sources, NDT techniques in operations. (Total tuition time: \pm 60 hours)

