

SAIW Centre for Welding Engineering Training

International Welding Engineer (IWE) and International Welding Technologist (IWT) training at the University of Pretoria

Background

South Africa is currently experiencing a severe shortage of qualified Welding Engineers, engineers in other disciplines with sufficient welding knowledge and experience and Welding Technologists. Engineers are generally in short supply in South Africa, and most of the engineers and technologists employed in the field of welding have very little formal training in the practical and theoretical aspects of welding. Between 2006, when SAIW Certification became the Authorised National Body (ANB) of the International Institute of Welding (IIW) in South Africa, and the end of 2011, an average of less than four International Welding Engineers (IWE's) were registered per year in this country.

The training of Welding Engineers and Welding Technologists is regulated internationally and the International Institute of Welding's training programme "International Education and Qualification System for Welding Personnel" is currently the only system recognised worldwide. In South Africa SAIW Certification (a Section 21 not-for-profit company, accredited with SANAS and the International Institute of Welding, responsible for the assessment and certification of welding personnel in South Africa) acts as the Authorised National Body (ANB) for IIW. The IIW programme is well supported by local and international industry and recognised by international training and accreditation entities, such as the current ISO and CEN bodies (recognised in ISO 14731: Welding Coordination - Tasks and Responsibilities).

In order to address the shortage of qualified Welding Engineers and Welding Technologists in South Africa, the IWE and IWT training courses are presented at the University of Pretoria through the SAIW Centre for Welding Engineering in the Department of Materials Science and Metallurgical Engineering (please refer to www.up.ac.za/welding for more information). As part of the accreditation procedure

for this programme, the University of Pretoria received full approval to operate as an Approved Training Body (ATB) from IIW and SAIW Certification (as the current Approved National Body of IIW in South Africa) at the beginning of 2012.

The University of Pretoria is the leading research university in South Africa (maintaining the highest research output of a South African university since 1996) and the largest residential university in the country (for more information, refer to the website of the University of Pretoria at www.up.ac.za). The Department of Materials Science and Metallurgical Engineering at the University of Pretoria (please refer to the department's website at www.up.ac.za/metal for more information) is well positioned with respect to welding-related research and teaching, building on a strong foundation of sustained welding research going back more than 20 years. The department's welding activities are supported by a strong research focus on physical metallurgy and corrosion and an excellent laboratory infrastructure. The department also maintains strong national and international links in the welding industry.

The current state of affairs in the local manufacturing and fabrication industry makes the more traditional on-campus model for training welding engineers and welding technologists impractical in the South African context. In the majority of cases postgraduate students study part-time whilst maintaining paid employment. The high demand for skilled technical personnel (especially qualified engineers) in South Africa makes it difficult for students to be away from work for extended periods of time to attend classes or courses at tertiary education institutions. This is compounded by the fact that a large geographical area needs to be served, with students being drawn from all over South Africa (and possibly from the rest of the African continent). Replicating the course in other geographical areas is uneconomical, unless justified by student numbers. In many cases students therefore have to travel and arrange accommodation for the duration of the course. To shorten the on-campus contact time, reduce costs and cater for the wide geographical distribution of prospective students, a flexible (distance) delivery alternative is preferred to the more widely employed on-campus IWE and IWT course delivery models.



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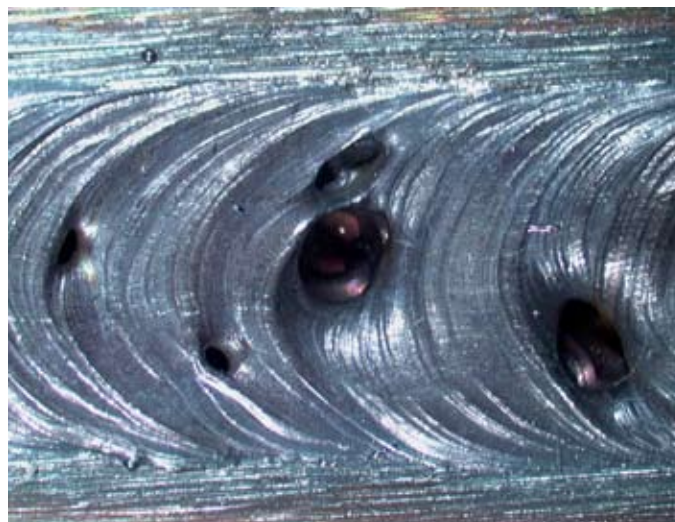
IWE/IWT Course At The University Of Pretoria

The IWE/IWT training course is presented in the form of four postgraduate modules as part of the well-established BEng(Honours) and BSc(Honours) Applied Science postgraduate degree programmes offered by the Department of Materials Science and Metallurgical Engineering at the University of Pretoria. The BEng(Honours) degree programme in Metallurgical Engineering - Option: Welding Engineering is a part-time course-based postgraduate degree that follows after a Bachelors degree in Engineering, and will accommodate those students who satisfy the access conditions for the IWE programme. The BSc(Honours) Applied Science programme in Metallurgy - Option: Welding Technology is a postgraduate course-based degree programme developed for students who do not have first degrees in Engineering, but satisfy the access conditions for the IWT programme. Based on the requirements of the Department of Higher Education and Training in South Africa, both programmes require successful completion of 128 SAQA (South African Qualification Authority) credits. These degree programmes are currently presented on a part-time block basis to facilitate attendance by part-time students and to encourage flexible learning.

To satisfy the requirements of the IWE and IWT programmes, four welding-related modules must be completed successfully. Each module corresponds to 32 SAQA credits, amounting to the full 128 credits required for the BEng(Honours) and BSc(Honours) Applied Science degree programmes on successful completion. The four modules are based on the four modules in the prescribed IWE/IWT syllabus and the module contents follow the guidelines presented in the documents IAB-252r1-11/SV-00 and IAB-195r1-07. IWE/IWT candidates have to successfully complete all four of the modules listed below (the University of Pretoria module code is shown in brackets):

- Welding Processes (NWP700)
- Welding Metallurgy (NSW700)
- Design of Welded Structures (NWP701)
- Fabrication Engineering (NFE700)

To accommodate students from the whole of South Africa and elsewhere on the African continent, a flexible learning approach is used. The IWE/IWT course follows the guidelines prescribed in IWT document IAB-195r1-07 and combines multimedia computer-based technology with four one week residential on-campus learning weeks.



Admission Requirements

The International Welding Engineer (IWE) course at the University of Pretoria is only accessible to students who are registered as Professional Engineers with the Engineering Council of South Africa (ECSA) at the time of application, or students who hold engineering qualifications accredited by ECSA as satisfying the educational requirements for registration as Professional Engineer. These qualifications include ECSA accredited Bachelor's degrees in Engineering (BEng or BScEng) from a South African university, or an equivalent foreign qualification recognised under the Washington Sydney or Dublin Accords.

The course is also accessible to students wishing to pursue the International Welding Technologist (IWT) qualification. In addition to the IWT requirements, these students have to satisfy the minimum access conditions of the School of Engineering at the University of Pretoria. As shown below, minimum requirements for entry are BTech or BSc degrees in a relevant discipline (with a minimum average of 60% for all final year subjects in the BTech or BSc programme). For more information, please refer to the Postgraduate Brochure of the Department of Materials Science and Metallurgical Engineering available on the department's website at www.up.ac.za/metal.

Table 1

Degree programme	Entry requirements
BEng (Honours) (Metallurgical Engineering) - Option: Welding Engineering (IWE programme)	A Bachelor's degree (BEng, BScEng or equivalent) in Engineering from an ECSA accredited degree programme in South Africa, or a four year (minimum) Engineering degree recognised under the Washington, Sydney or Dublin Accords.
BSc (Honours) (Applied Science: Metallurgy) - Option: Welding Technology (IWT programme)	<p>A BSc or BTech degree in a relevant discipline, or an Engineering degree in a relevant discipline from a University not recognised under the Washington, Sydney or Dublin Accords.</p> <p>The following access conditions for the BSc(Hons)(Applied Science) programme will be strictly enforced:</p> <ul style="list-style-type: none"> • An average of 60% or higher for all subjects in the applicant's last academic year (i.e. BTech year, or last academic year of a BSc or BScEng degree). • No subjects failed or repeated in the applicant's last academic year (i.e. BTech year, or last academic year of a BSc or BScEng degree). <p>Holders of National Higher Diplomas can be admitted through Recognition of Prior Learning.</p>

Course Presentation

Flexible learning through web-based support:

Flexible learning combines the most appropriate learning materials to enable students to study in their own time at remote locations. The University of Pretoria has considerable experience in flexible delivery systems and offers extensive web-based learning support through the ClickUP WebCT system. The backbone of this course will be computer-based self-study material supplied to students in DVD format or internet download in addition to the formal study material (course notes, supplementary reading material and electronic references).

The multi-media material, IWE Part 1 and IWE Part 3, will be supplied to students on both the IWE and IWT programmes as compulsory self-study material. This material was developed in Germany by GSI (Gesellschaft für Schweißtechnik International) and fully complies with the requirements of the IAB Distance Learning guideline IAB 195-r2.

Part 1 (88 hours) covers the first part of the IWE/IWT course according to IIW Guideline IAB-252r1-11/SV-00. The material will be supplied in the form of a DVD or internet download and covers the basic principles of the following study themes:

- **Module 1:** Welding processes and equipment
- **Module 2:** Materials and their behaviour during welding
- **Module 3:** Construction and design

Part 3 (145 hours) covers more advanced computer-based self-study material for the IWE/IWT course and fully complies with IIW guidelines (the material is also supplied in DVD format or internet download). The following study-themes are covered:

- **Module 2:** Materials and their behaviour during welding
- **Module 3:** Construction and design
- **Module 4:** Fabrication, applications engineering

Lecture notes for the on-campus learning weeks were self-developed by the University of Pretoria, and are fully approved by the ANB.

Residential on-campus learning weeks

All students registered on the IWE/IWT course will be required to attend four compulsory one-week (5 or 6 days) residential schools at the University of Pretoria. These schools aim to supplement the distance delivery material through formal lectures, laboratory exercises, case studies and presentations by industry experts. All lecturing is performed by staff members and guest lecturers approved by the ANB.

On conclusion of each residential school each student has to submit an assignment, which accounts for 30 to 40% of the final mark awarded in the module. Each of the four assignments amount to approximately 15 additional hours of guided work.

On conclusion of each residential school, students will write a formal written examination on all study material covered in the relevant module (with the mark awarded in the examination counting towards 60 to 70% of the final mark in the module). The scheduled dates for the on-campus residential schools are in the Postgraduate Brochure published on the department's website at www.up.ac.za/metal.



Course structure

An overview of the proposed course structure is given in Table 2. The total on-campus lecturing time is 150 hours of contact time, with 88 hours (Part 1) and 145 hours (Part 3) allocated for Distance Learning. In addition to the web-based learning and formal contact time described above, students on the IWE/IWT programme have to complete 60 hours of practical welder training at ANB approved local providers. On successful completion of the course and practical training, a student can apply to SAIW Certification for registration as an International Welding Engineer or International Welding Technologist. Depending on their performance in the examinations, IWE candidates may be invited for an oral examination or professional interview at SAIW Certification to assess their level of knowledge and understanding of the subject material before the IWE certificate can be issued. Any student who achieves 75% or more in any particular module will be exempted from the oral examination on the contents of that particular module. Oral examinations are not mandatory for IWT candidates, but may be required by the Examination Board in borderline cases.

Assessment

Course assessment is continuous and is based on assignments and a formal written examination on conclusion of each module. The final examination in each module is written on-campus in accordance with the University of Pretoria's examination regulations. The final examination paper for each module is developed jointly by the University of Pretoria and SAIW Certification (as the ANB of the International Institute of Welding in South Africa) and formally approved by the ANB, and satisfies the requirements of both the University of Pretoria and the International Institute of Welding. This negates the need for two separate examinations, as is current practice in South Africa. The final examination in each module is a three hour written examination consisting of essay type questions, supported by a multiple choice paper from the IIW question bank. Different examination papers are issued to IWE and IWT candidates. Marking of the question papers is performed by both the University of Pretoria and the ANB, and moderated by an external examiner appointed by the University of Pretoria (and approved by the ANB).

To satisfy the International Institute of Welding's requirements for registration as International Welding Engineer (IWE) or International Welding Technologist (IWT), all candidates have to achieve a minimum final mark of 60% in each of the four modules. Students who pass the module but do not achieve a minimum of 60% are permitted to re-sit the IIW examinations a maximum of two times. The marks achieved in this additional examination will not be reflected on the student's academic record (according to the regulations of the University of Pretoria no supplementary examinations may be granted for postgraduate modules).

Costs

The course fees for the IWE/IWT programmes are determined by the University of Pretoria and will be published on the department's website at the beginning of each academic year. Additional fees for the compulsory web-based learning material and practical welder training will be levied.

Contact Information

For more information, please refer to www.up.ac.za/welding or contact:

Prof Madeleine du Toit, PrEng PhD IWE
SAIW Centre for Welding Engineering
Department of Materials Science and Metallurgical Engineering
University of Pretoria
Pretoria, 0002
South Africa
Tel: +27 12 420 2187
Fax: +27 12 362 5304
e-mail: madeleine.dutoit@up.ac.za

Table 2

IIW Module	General Study Themes	On-Campus Module
A. Welding processes and equipment	<ol style="list-style-type: none"> 1. Introduction to materials joining 2. Fusion welding processes 3. Non-fusion welding processes 4. Other processes (including cutting, surfacing and spraying) 5. Joining of plastics, ceramics and composites 	Welding Processes (NWP700)
B. Materials and their behaviour during welding	<ol style="list-style-type: none"> 1. Introduction to materials 2. General welding metallurgy 3. Welding of ferrous alloys (including steels, stainless steels and cast iron) 4. Welding of non-ferrous alloys (including Cu and Cu alloys, Ni and Ni-base alloys, Al and Al alloys, other metals, dissimilar metal welding, wear) 	Welding Metallurgy (NSW700)
C. Construction and design	<ol style="list-style-type: none"> 1. Introduction 2. Design of welded structures with predominantly static loading 3. Design of dynamically loaded welded structures 4. Design of welded pressure equipment, aluminium alloy structures and reinforcing steel welded joints 	Design of Welded Structures (NWP701)
D. Fabrication application engineering	<ol style="list-style-type: none"> 1. Quality assurance and control in welded fabrication 2. Residual stress and distortion 3. Health and safety 4. Plant facilities, welding jigs and fixtures 5. Measurement, control and recording in welding 6. Non-destructive testing 7. Case studies 8. Other 	Fabrication Engineering (NFE700)



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