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Engineering Qualifications and the Higher Education Qualifications Sub- Framework (HEQSF) *(previously HEQF)*

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The purpose of this presentation is to give an overview of the revised HEQSF, how it fits into the NQF, and the associated qualification standards developed for technicians, technologists and engineers

The NQF

The National Qualifications Framework (NQF) has ten levels, each with an associated level descriptor and *three sub-frameworks*:

- a) *General and Further Education and Training Qualifications Sub-framework (GFETQSF)*, contemplated in the General and Further Education and Training Quality Assurance Act, 2001 (Act 58 of 2001), which is developed and managed by Umalusi;
- b) *Higher Education Qualifications Sub-framework (HEQSF)*, contemplated in the Higher Education Act, 1997 (Act 101 of 1997), which is developed and managed by the Council on Higher Education (CHE);
- c) *Trades and Occupations Qualifications Sub-framework*, commonly known as the Occupational Qualifications Sub-framework (*OQSF*), contemplated in the Skills Development Act, 1998 (Act 97 of 1998), which is developed and managed by the Quality Council for Trades and Occupations (QCTO).

The NQF

NQF AS ON 14 DEC 2012

Doctoral Degree			HEQF	Level 10	OQS (QCTO) Occupational Certificates
Masters Degree				Level 9	
Postgraduate Diploma Honours Degree				Level 8	
Bachelor Degree Advanced Diploma				Level 7	
Diploma Advanced Certificate			Level 6		
Higher Certificate		L5 pending	GFETQF Incl. subject / unit certificates	Level 5	
National Senior Certificate (Grade 12)	Adult National Senior Certificate	National Certificate (Vocational) 4		Level 4	
	Units of learning to be accumulated	National Certificate (Vocational) 3		Level 3	
		National Certificate (Vocational) 2		Level 2	
General Education & Training Certificate (Grade 9)	Adult National Senior Certificate			Level 1	

HEQSF
(HEQC)

GFTEQSF
(Umalusi)

L7-10 pending

OQS
(QCTO)

Occupational
Certificates



The HEQSF

The revised HEQSF, in line with the previous framework, provides the basis for integrating all higher education qualifications into the National Qualifications Framework (NQF).

It provides a basis for standards development and quality assurance. It provides a mechanism for improving the coherence of the higher education system and indicates the articulation routes between qualifications, thereby enhancing the flexibility of the system and enabling students to move more efficiently over time from one programme to another as they pursue their academic or professional careers.

The HEQSF

The HEQSF establishes common parameters and criteria for qualifications design and facilitates the comparability of qualifications across the system. Within such common parameters programme diversity and innovation are encouraged.

Higher education institutions have a broad scope within which to design educational offerings to realise their different visions, missions and plans and to meet the varying needs of the stakeholders and communities they serve.

Who is responsible for what ?

The Minister of Higher Education and Training has overall responsibility for the NQF and for determining the qualifications structure for the higher education system.

The South African Qualifications Authority (SAQA) is responsible for the development of policy and criteria for registering standards and qualifications on the NQF on recommendation from the Quality Councils (QCs).

The CHE is responsible for the development and management of the HEQSF and for advising the Minister on matters relating to the HEQSF, for the development of standards and quality assurance through its permanent sub-committee (HEQC).

Who is responsible for what ?

Since ECSA is a statutory body established in terms of the Engineering Professions Act (46 of 2000) to regulate engineering professions, the CHE agreed by means of an MoU to work with ECSA to accomplish quality assurance and standards generation for engineering qualifications.

The Engineering Standards Generating Body (ESGB) is a high impact committee of ECSA.

The ESGB develops and recommend to the ECSA council relevant competency and qualification standards for engineering practitioners at levels 5 – 10 of the NQF in compliance with one or all of the relevant QCs.

Who is responsible for what ?

The ESGB has Standard Generating Groups (SGGs) to deal with matters pertaining to the generation of standards for a specific registration category or discipline.

The rest of this presentation will focus on the revised HEQSF and the associated education standards developed by for technicians, technologists and engineers.

HEQSF Menu

Qualification Type	Credits at Level (= Exit Level)						
	Total	5	6	7	8	9	10
Higher Certificate in __ [in __]	≥120	120					
Advanced Certificate	≥ 120		120				
Diploma (<i>without workplace-based credits</i>)	≥ 240		120				
Diploma (<i>with up to 120 workplace-based credits</i>)	≥ 360		120				
Advanced Diploma	≥ 120			120			
Bachelor of __ in __ (<i>typically 3-years</i>)	≥ 360			120			
Bachelor of __ in __ (<i>typically 4-years</i>)	≥ 480				120		
Bachelor Honours	≥ 120				120		
Postgraduate Diploma	≥ 120				120		
Masters	≥ 180					120	
Doctoral	≥ 360						360

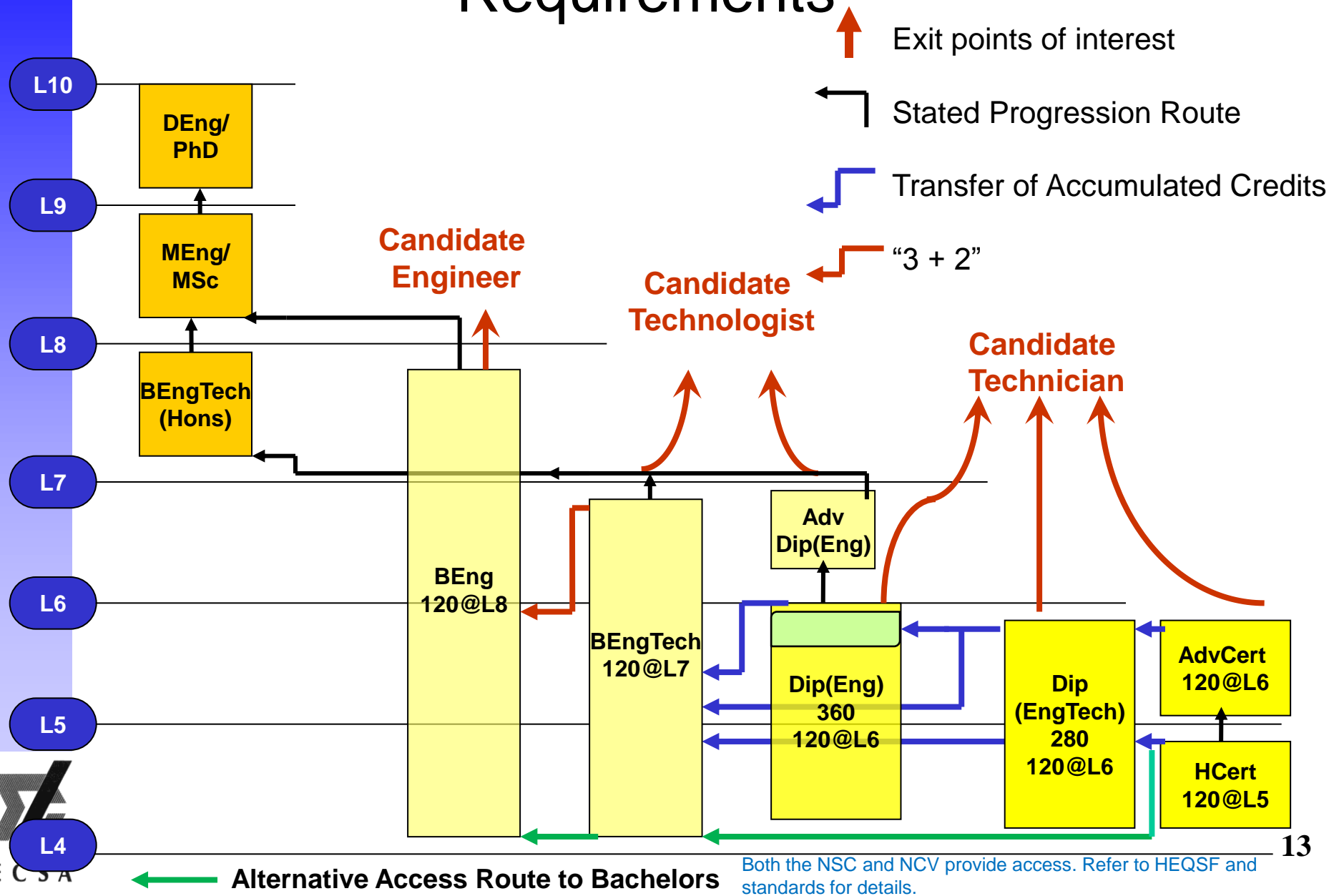
ECSA Standards Developed (*Feb 2013*)

Qualification Type	Credits at Level (minima unless shown = Exit Level)						
	Total	5	6	7	8	9	10
HCert(____Eng) (____)	140	120	Engineering Support Occupations				
AdvCert(____Eng) (____)	140		120	Candidate Technician (*without <u>workplace-based</u> credits) (**with <u>workplace-based</u> credits)			
Dip(EngTech)(____)(____)	280*		120				
Dip(Eng) (____) (____)	360**		120				
AdvDip(Eng) (____) (____)	140			120	Candidate Technologist		
BEngTech (____) (____)(typically 3-years)	420			120			
BEng (____) (____)(typically 4-years)	560				120	Candidate Engineer	
BEngTech(Hons) (____) (____)	140				120	***	

*** Provides access to MEng or Professional Masters (still to be developed)

Developed standards have been gazetted for public comment and are compliant to the CHE framework for qualification standards in HE (2nd draft, 7 Feb 2013)

HEQSF and ECSA Educational Requirements



Both the NSC and NCV provide access. Refer to HEQSF and standards for details.

Engineering Qualifications Nomenclature

Examples

(Refer to both HEQFS and ECSA standards for detail)

HCert(Civil Engineering)(Construction)
AdvCert (Civil Engineering)(Construction)
Dip(EngTech) (Civil Engineering)(Construction)
Dip(Eng) (Civil Engineering)(Construction)
AdvDip(Eng) (Civil Engineering)(Construction)
BEngTech (Civil Engineering)(Structures)
BEng(Civil Engineering)
BSc(Eng)(Civil Engineering)
BEngTech (Hons)(Civil Engineering)(Structures)
MEng (Civil Engineering)(Structures)

MEng / MSc(Eng) = point of convergence for all streams of engineering qualifications: BEng and BEngTech(Hons) both provide access.

Internationally Aligned Profiles

Professional Engineers (L8)	Professional Engineering Technologists / Certificated Engineers (L7)	Professional Engineering Technicians (L6)
are characterised by:		
<p>Solve complex problems: <i>Unfamiliar problems with large uncertainty and many conflicting constraints</i></p>	<p>Solve broadly-defined problems: <i>Problems with some uncertainty and conflicting constraints where solutions partially fall outside standard codes and procedures</i></p>	<p>Solve well-defined problems: <i>Concrete problems with few conflicting constraints that can be solved using standard codes and procedures</i></p>
<p>Design experiments and analyze and synthesize complex information to arrive at conclusions</p>	<p>Design experiments and execute tests and measurements to arrive at conclusions</p>	<p>Search relevant codes and catalogues and execute routine tests and measurements</p>
<p>Use sophisticated strategies and tools to design and oversee potentially very complex systems, components and processes</p>	<p>Execute design functions and contribute to the design of systems, components or processes</p>	<p>Use design recipes to execute simple design functions</p>

Internationally Aligned Profiles....

Professional Engineers (L8)	Professional Engineering Technologists / Certificated Engineers (L7)	Professional Engineering Technicians (L6)
Activities involving diverse resources, interact significantly, and extend beyond the use of existing materials and techniques	Activities involving a variety of resources, might interact and often require the use of new materials and techniques in novel ways	Activities involving limited resources, have limited interaction, and require standard materials and techniques
etc.....To achieve this their knowledge encompasses		
<ul style="list-style-type: none"> • a broad, fundamentals-based appreciation of engineering sciences, with depth in specific areas, together with financial, commercial, legal, social and health, safety and environmental matters 	<ul style="list-style-type: none"> • an understanding of engineering sciences underlying a deep knowledge of specific technologies, together with financial, commercial, legal, social and health, safety and environmental matters 	<ul style="list-style-type: none"> • a working understanding of engineering sciences underlying the techniques used, together with financial, legal and health, safety and environmental methodologies



Work Integrated Learning Issues

The HEQSF conflates WIL and 'co-operative education'. There continues to be definitional (and conceptual) confusion regarding WIL. Terms used both in South Africa and internationally such as 'cooperative education', 'experiential learning', 'workplace learning', or 'workplace-based learning' tend to have a narrow focus on learning in a work context, and are seen as separate from the academic curriculum.

ECSA defines WIL as an educational approach that *aligns and integrates* academic and workplace practices for the mutual benefit of students and workplaces. WIL is based on the principle that learning should be demonstrated to be appropriate for a qualification and should be assessed wherever it takes place or is provided.

Work-Directed Theoretical Learning, Simulated Learning using Problem-based Learning and Project-based Learning are not WIL per definition, but ***may*** be used to incorporate WIL in a qualification.

Work Integrated Learning Issues....

In conclusion, all ECSA standards for technology qualifications (Cert, AdvCert, Dip, AdvDip, BEngTech..) make provision for incorporating WIL.

Note however that the HEQSF distinguishes between the 280 (240) and 360 Diploma qualifications based on **Workplace-based Learning** (*needs to be in workplace*). Both should include WIL (broader definition) but according to the HEQSF, the 360 Diploma **may** include up to 120 workplace-based learning credits. Refer to the ECSA 360 and 280 Diploma standards for more detailed information. The ECSA 360 Diploma standard specifies a minimum of 30 credits (one semester) of WIL.

Exit Level Outcomes: Common Stem

ELO 1: identify, assess, formulate and solve engineering problems	ELO 6: communicate effectively, both orally and in writing, with engineering & wider audiences
ELO 2: use math, basic science & engineering science knowledge to solve engineering problems	ELO 7: assess impact of engineering activity on social, industrial & physical environment
ELO 3: perform design and synthesis of solutions	ELO 8: knowledge of engineering management and to work effectively as an individual, in teams.
ELO 4: design and conduct investigations and experiments	ELO 9: engage in independent learning through well developed learning skills.
ELO 5: use appropriate engineering methods, skills and tools , including those based on IT	ELO 10: act professionally and ethically , exercise judgment and take responsibility within own limits



Form of Outcome Statement

Engineer (L8)	Engineering Technologist (L7)	Engineering Technician (L6)
Conduct investigations of <u>complex problems</u> including <ul style="list-style-type: none"> • design of experiments, • analysis and interpretation of data, • synthesis of information to provide valid conclusions 	Conduct investigations of <u>broadly-defined</u> problems; <ul style="list-style-type: none"> • locate, search and select relevant data from codes, data bases and literature, • design and conduct experiments to provide valid conclusions. 	Conduct investigations of <u>well-defined</u> problems; <ul style="list-style-type: none"> • locate and search relevant codes and catalogues, • conduct standard tests and measurements.

- This is the ELO 4 “Investigation and Experimentation” outcome across three Stage 1 programs

Knowledge Base

- Minimum total credits
- Credits at exit level
- Baseline credits in each knowledge area

Knowledge Area
Mathematical Sciences
Natural Sciences
Engineering Sciences
Engineering Design
Computing & IT
Complementary Studies
Work Integrated Learning
For redistribution

Higher Certificate / Engineering Support Occupations Baseline (L5)

Knowledge Area	H Cert (A)	H Cert (B)
Mathematical Sciences	14	7
Natural Sciences	7	7
Engineering Sciences	63	56
Engineering Design	14	7
Computing & IT	14	14
Complementary Studies	7	7
For Redistribution	21	42
Total	140	140

*H Cert (A):
Minimum credits
to progress to
Advanced
Certificate*

*H Cert (B):
For Engineering
Support
Occupations
with no need to
progress to
Advanced
Certificate*

Technician Baseline (L6)

Knowledge Area	Adv Cert* / 280 Dip	360 Dip
Mathematical Sciences	28	35
Natural Sciences	21	28
Engineering Sciences	126	126
Engineering Design	28	28
Computing & IT	21	21
Complementary Studies	14	14
WIL	-	30
For Redistribution	42	78
Total	280*	360

*140 HCert +
140 AdvCert

Illustrative Cert and Diploma Structure

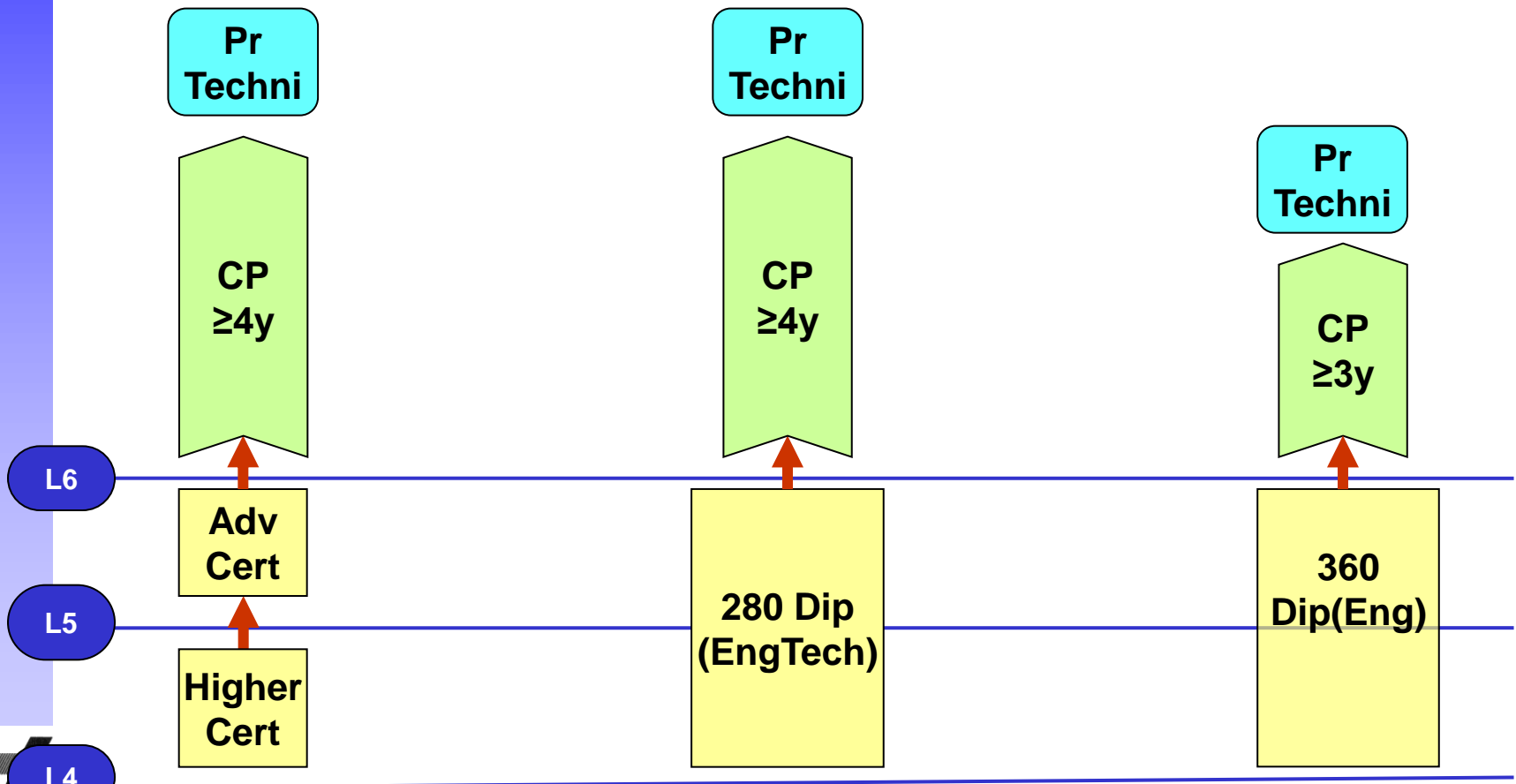
Semester		Part B of 360 Diploma			
6	MS-R	ES-R	ES-R	ED-R	NS-R
5	Workplace-based Learning				

Advanced Certificate		280 Diploma / Part A of 360 Diploma			
4	ES	ES	ES	ED	R
3	ES	CIT-R	ES	CS	R
		NS			
Higher Certificate					
2	MS	ES	ES	ED	CIT
1	MS	NS	ES	ES	R

Each block represents ~ 14 credits R = Redistributable Credits

Note that subjects and credits can be aligned, but that the Higher /Adv Certfs cannot be early exits for Diploma students

Professional Registration as a Technician



CP = candidacy phase.

Technologist Baseline (L7)

Knowledge Area	Adv Dip	BEngTech
Mathematical Sciences	14	42
Natural Sciences	7	28
Engineering Sciences	28	140
Engineering Design & Synthesis	21	49
Computing & IT	7	21
Complementary Studies	14	28
For Redistribution	49	112
Total	140*	420

*360 Dip + 140 Adv Dip – ECSA Standard written such that Adv Dip only follows 360 Dip. **Both** the Adv Dip and BEngTech provide access to BEngTech(Hons)

Illustrative BEngTech Structure

Years

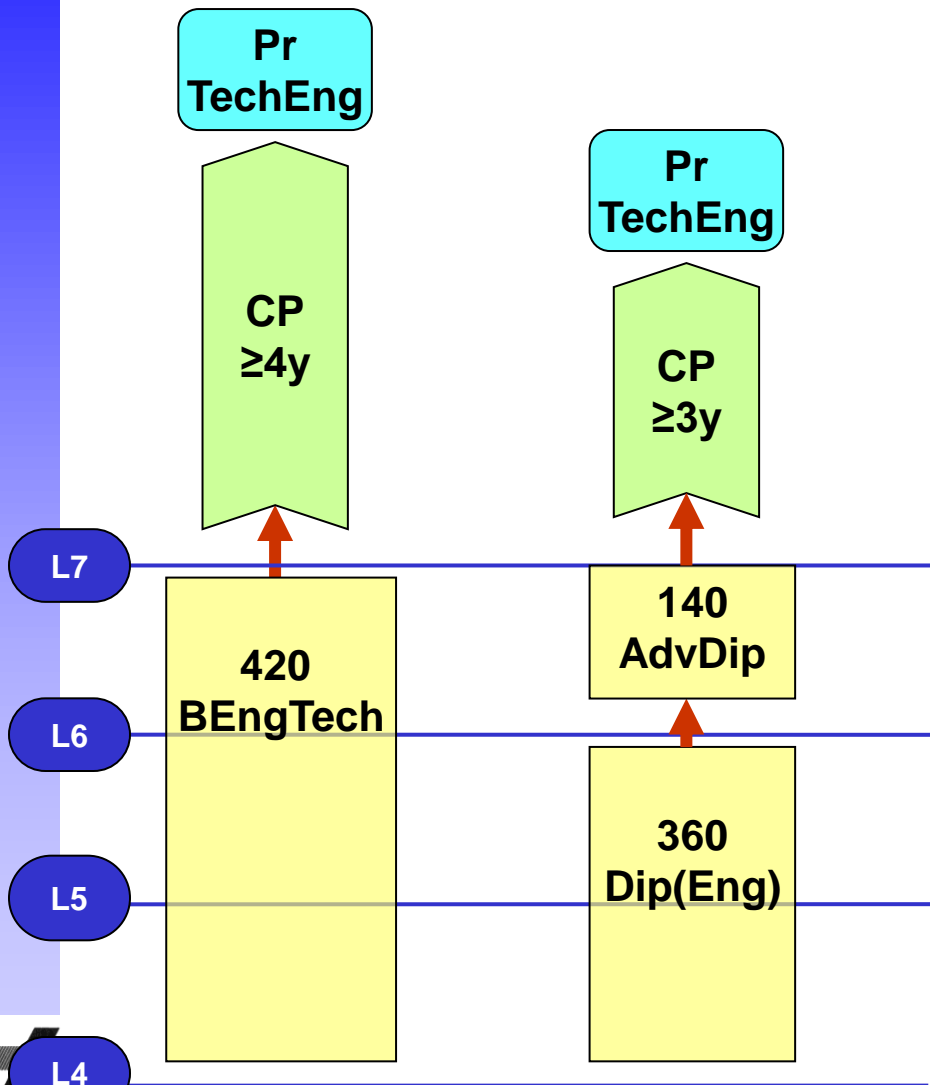
3	ES	ES	CS	Industrial Project (Engineering Design and Synthesis)	
			ES-R		
2	MS-R	ES	ES	ES-R	CS-R
	MS			CIT	NS-R
1	MS	ES	ES-R	CIT	NS
			CS	R	

Each full block represents 28 credits (1/5 of total hours / year course)

Each half block represents 14 credits (1/10 of total hours / semester course)

R = Redistributable Credits

Professional Registration as a Technologist

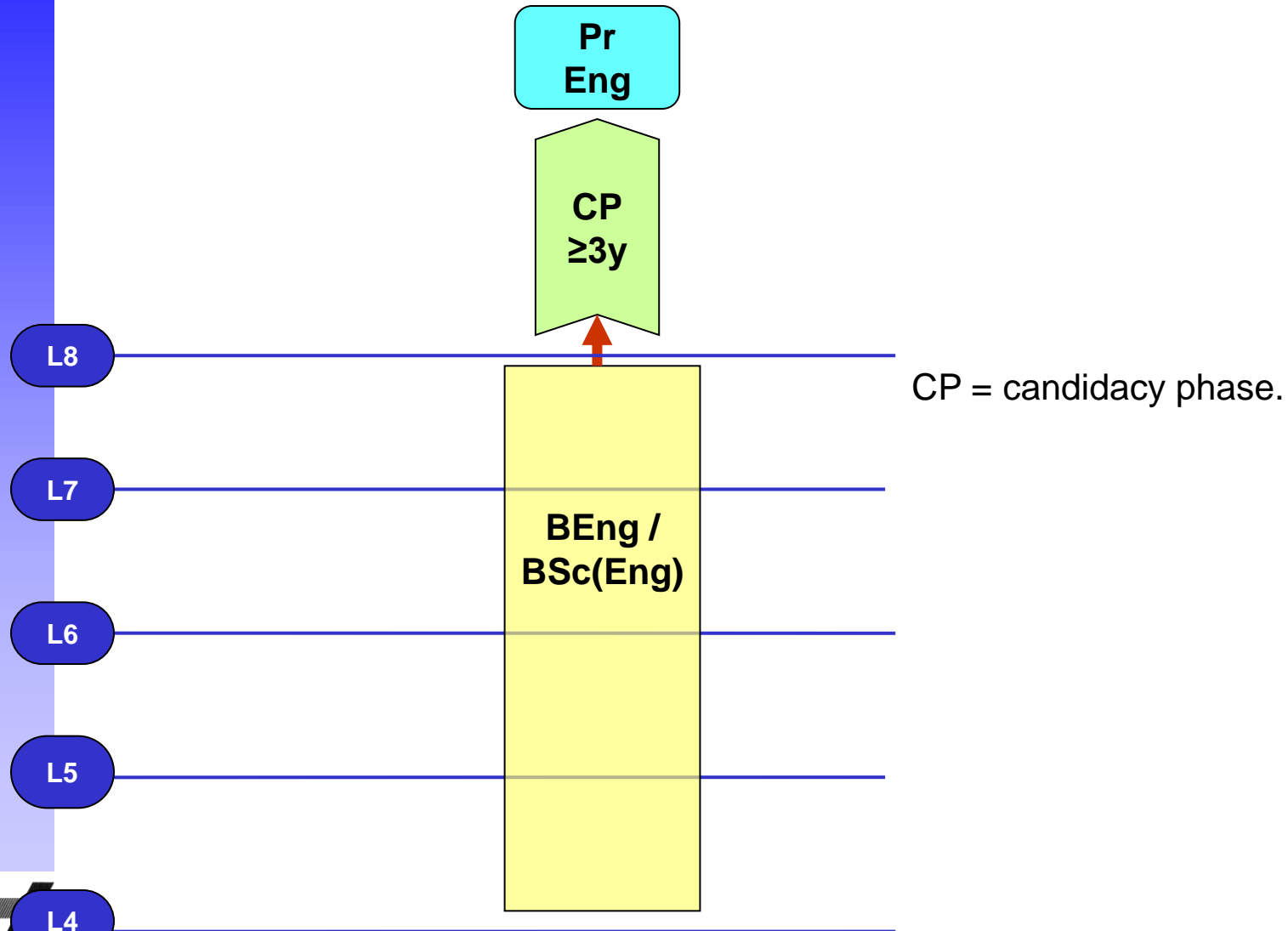


CP = candidacy phase.

Engineer Baseline (L8)

Knowledge Area	BEng / BSc(Eng)
Mathematical Sciences	56
Natural Sciences	56
Engineering Sciences	180
Engineering Design & Synthesis	72
Complementary Studies	56
For Redistribution	≥140
Total	≥ 560

Professional Registration as an Engineer



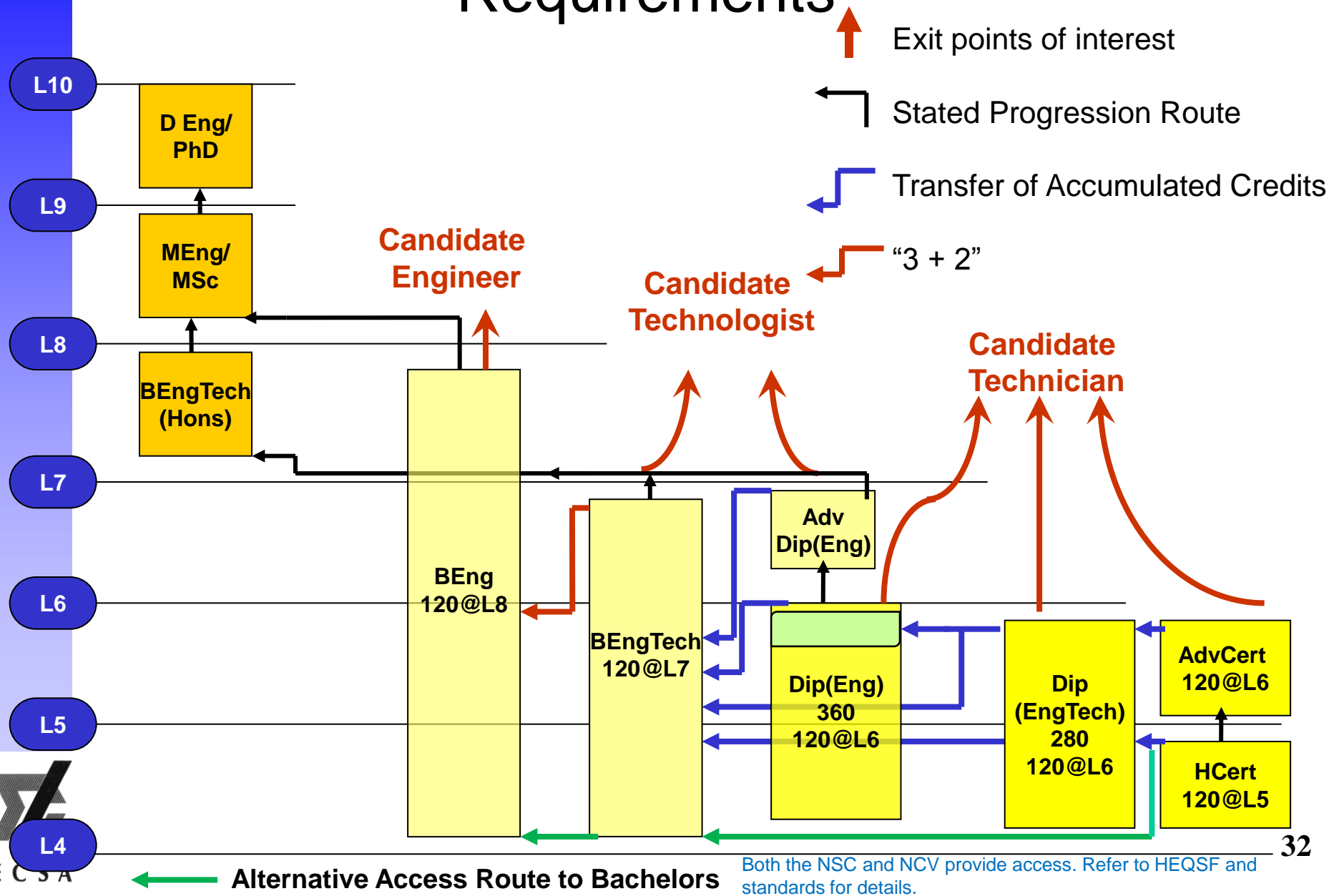
BEngTech (Hons) (L8)

Knowledge Area	BEngTech (Hons)*
Mathematical Sciences	7
Natural Sciences	14
Engineering Sciences	42
Engineering Design & Synthesis	28
Computing & IT	7
Complementary Studies	7
For Redistribution	35
Total	140**

*Provides access to MEng /MSc or Professional Masters (still to be developed)

** Total credits should include a research project of at least 30 credits. These credits will include knowledge from the Engineering Science, Engineering Design and Synthesis and other knowledge areas.

HEQSF and ECSA Educational Requirements



Both the NSC and NCV provide access. Refer to HEQSF and standards for details.

<http://www.ecsa.co.za>