New Engineering Qualifications

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10 November, 2015

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The HEQSF menu (courtesy of ECSA, 2013)

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 *(without workplace-based credits)*	≥ 240		120				
Diploma *(with up to 120 workplace-based credits)*	≥ 360		120				
Advanced Diploma	≥ 120			120			
Bachelor of ___ in ___ *(typically 3-years)*	≥ 360			120			
Bachelor of ___ in ___ *(typically 4-years)*	≥ 480				120		
Bachelor Honours	≥ 120				120		
Postgraduate Diploma	≥ 120				120		
Masters	≥ 180					120	
Doctoral	≥ 360						360

ECSA's menu options….

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 _workplace-based_ credits) (**with _workplace-based_ 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**	***	

New ECSA educational paths

Why? Why would anyone do this?

- **CHE**:

  However you look at it, the NDip to BTech to MTech is skipping a level somewhere. Let's get everything on the same levels.

- **ECSA:**

  It doesn't *really* matter how much time you spend in school. It matters what you can *DO.*

  One year of BTech isn't enough to change the things you can *do* in a fundamental, substantial way.

  WIL (or rather WBL) is a means to an end, and a somewhat problematic one.

(These are NOT quotes, but my own interpretation!)

What are the things that make desirable graduates?

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- Not just technical knowledge, which can always be referred to later

- Not just experience (WIL), which is not an end unto itself

What are the things that make desirable graduates?

- Not just technical knowledge, which can always be referred to later

- Not just experience (WIL), which is not an end unto itself

Abilities
What can you do?

Understanding
What can you apply?

Skills
Can you communicate?
Can you solve problems?

Characteristics
Are you hard-working?
Do you work well with others?

What makes a technologist?

From the ECSA standard:

"… solve broadly-defined problems

… develop components, systems, services and processes

… the application of technology in safety, health, engineering

… well-developed interpersonal skills

… work independently and responsibly

… specialized understanding of engineering sciences

… financial, commercial, legal, social and economic, health, safety and environmental matters."

What makes a technologist?

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Shift AWAY from standardised curricula. More flexibility and freedom for institutions and students…

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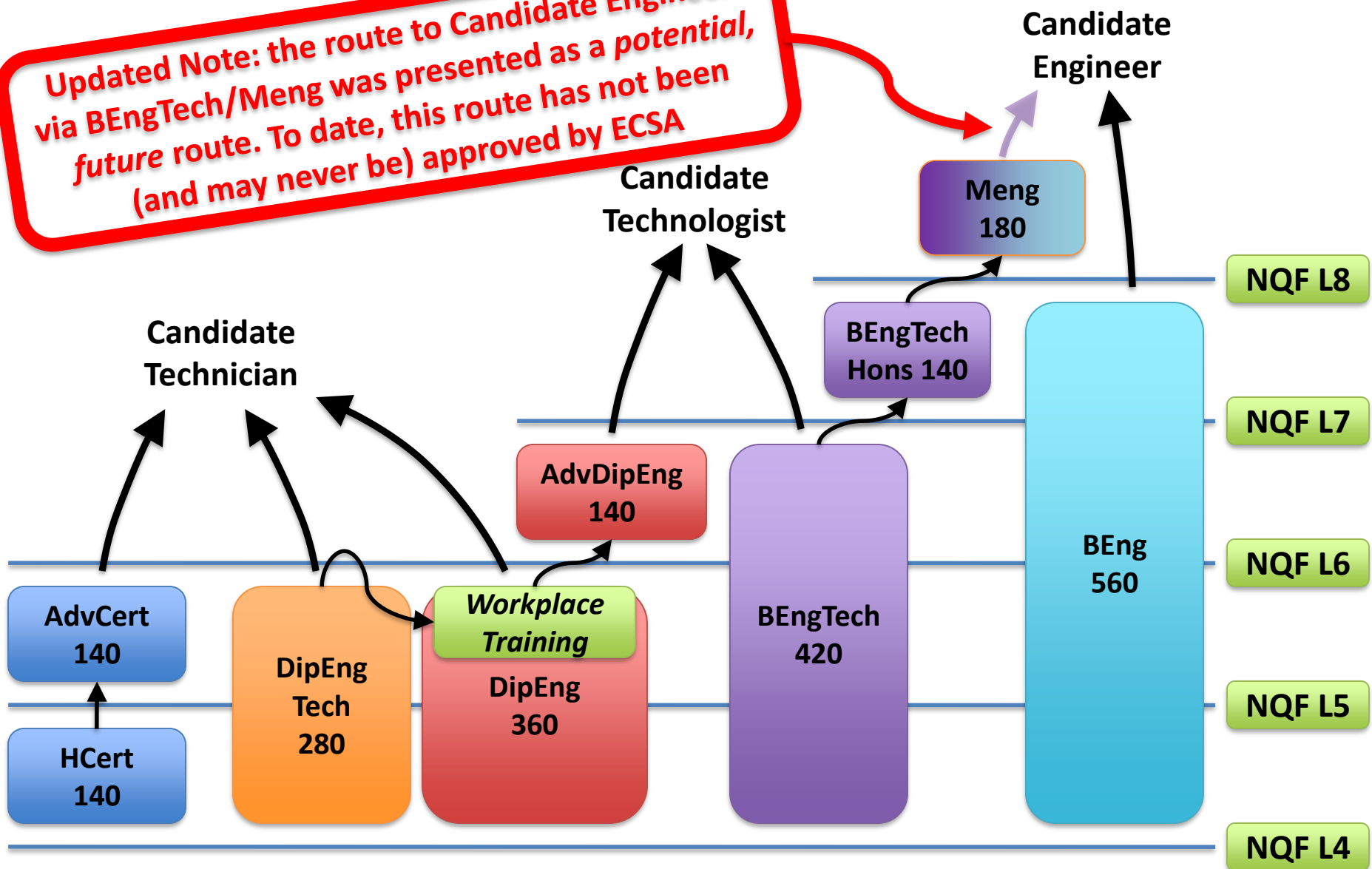Shift AWAY from standardised curricula. More flexibility and freedom for institutions and students… and industry!

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New ECSA educational paths

CDIO framework

Conceive → **Design** → **Implement** → **Operate**

Rethinking Engineering Education: The CDIO Approach; Crawley, E.F., Malmqvist, J., Östlund, S., Brodeur, D.R., Edström, K.; Springer; 2nd ed., 2014

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CDIO framework

Product, process, or system lifecycle

Conceive

Design

Implement

Operate

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CDIO framework

Product, process, or system lifecycle

Conceive

Design

Implement

Operate

Engineer

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CDIO framework

Product, process, or system lifecycle

Conceive

Design

Implement

Operate

Engineer

Technician

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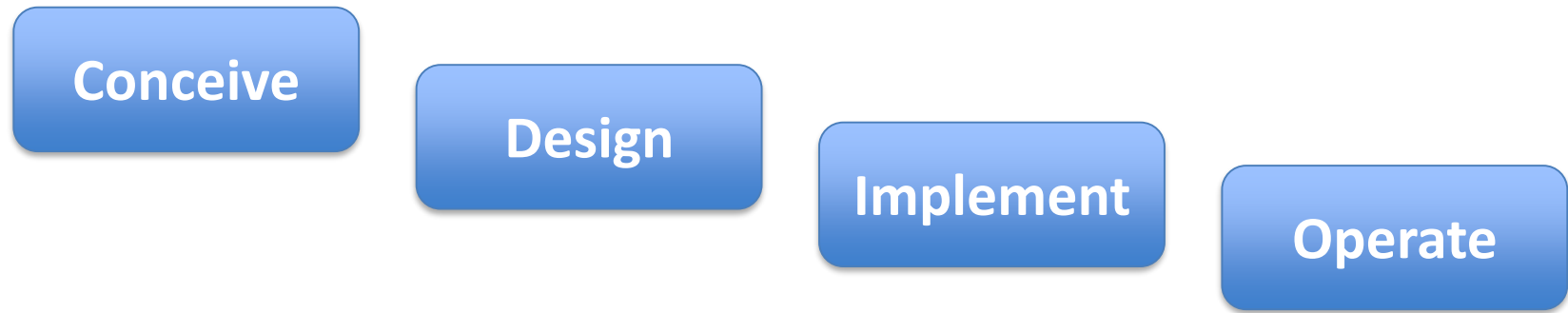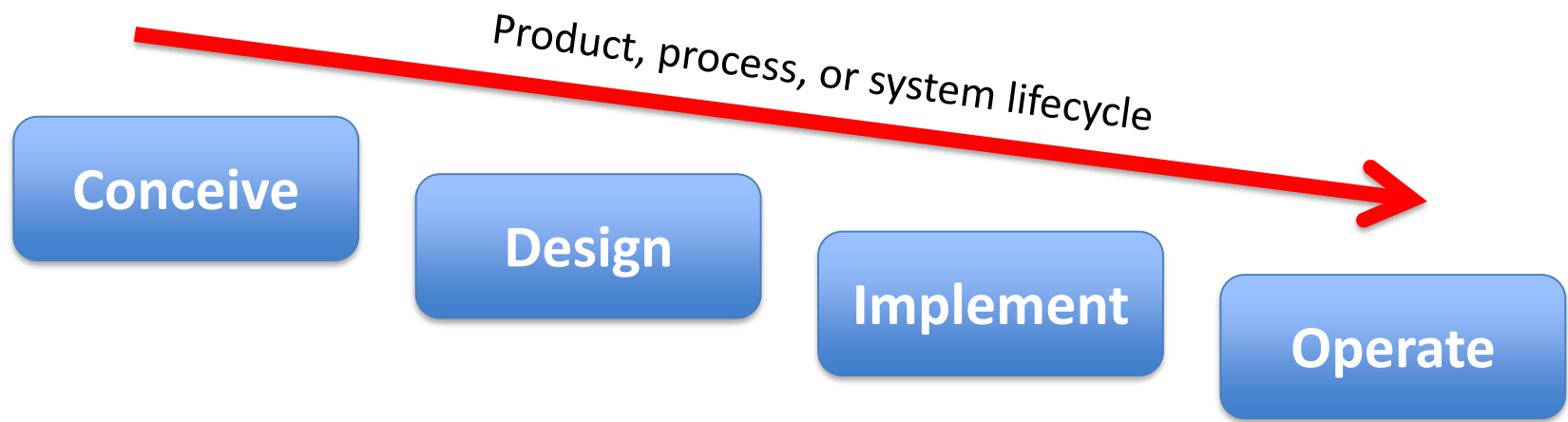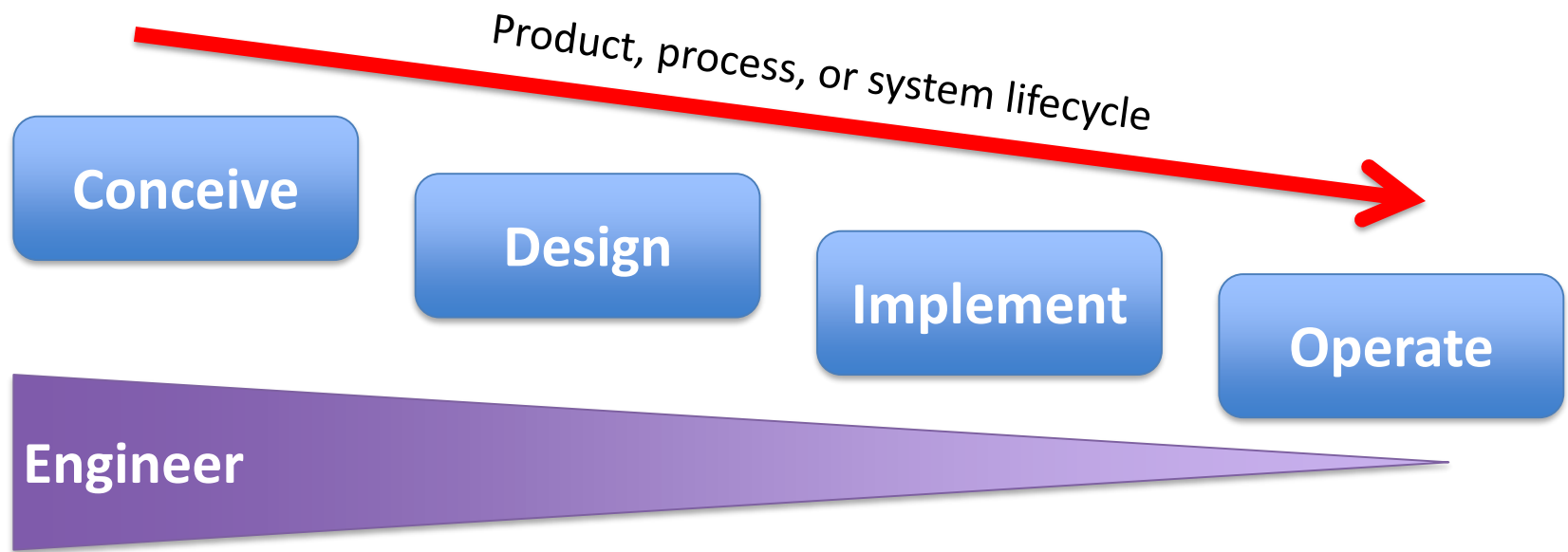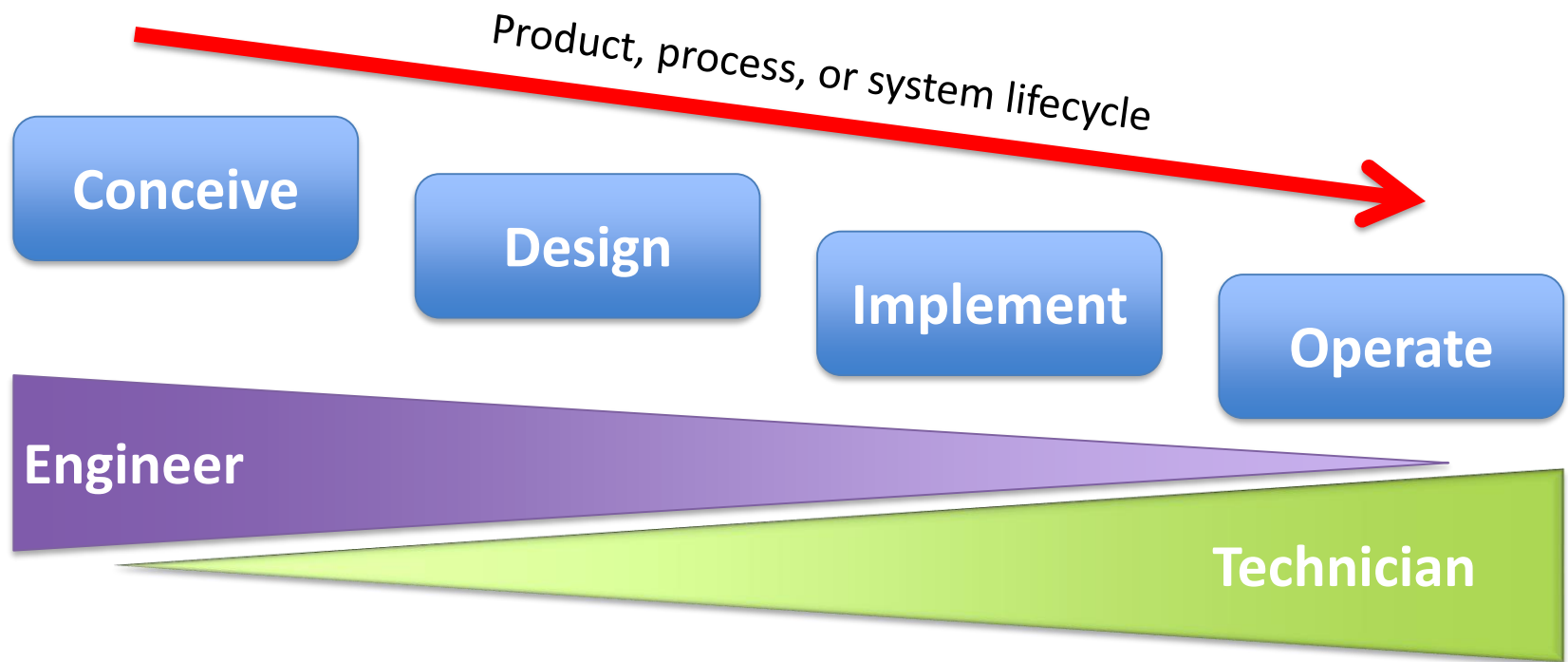
CDIO framework
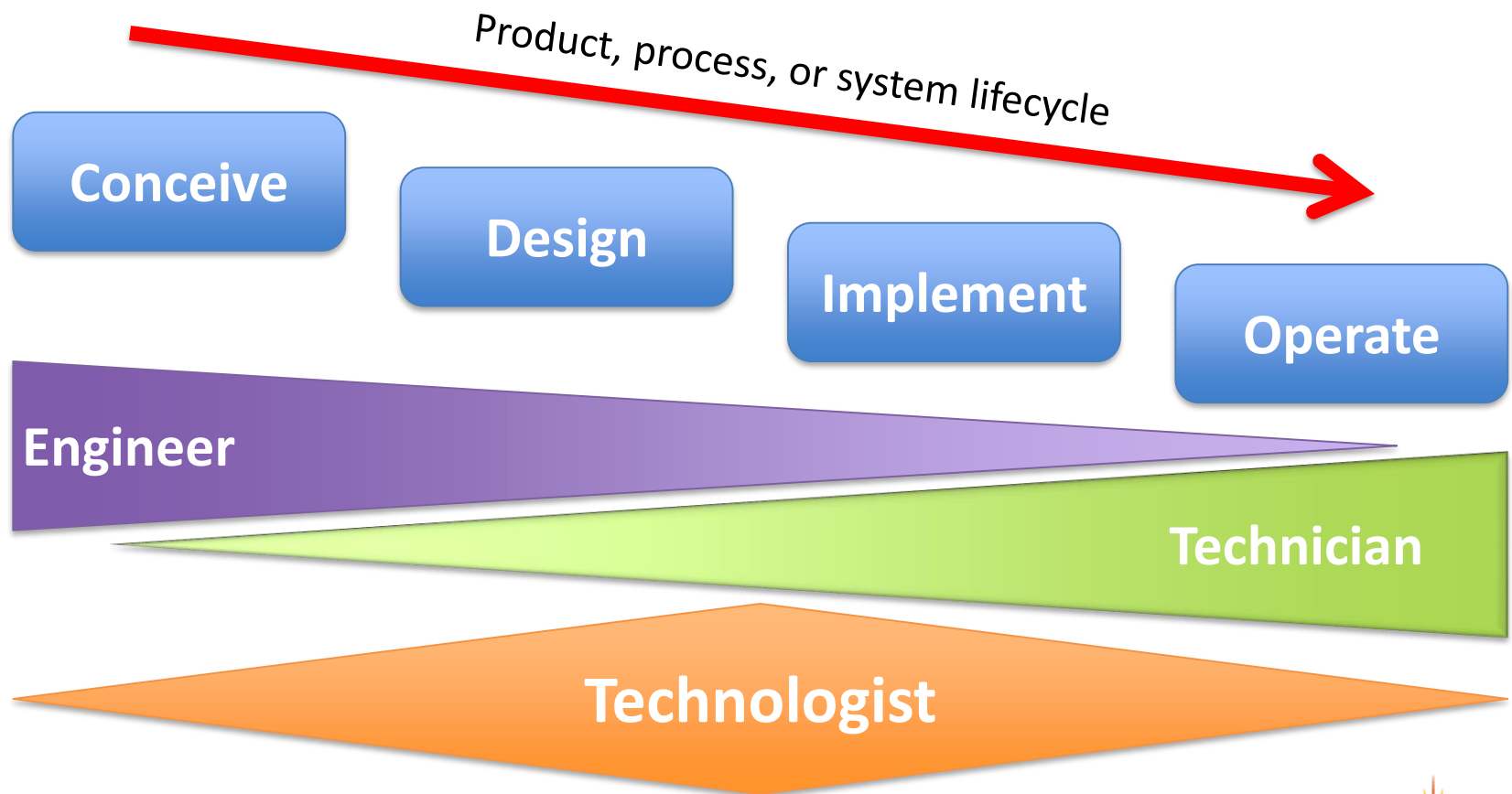
New ECSA educational paths
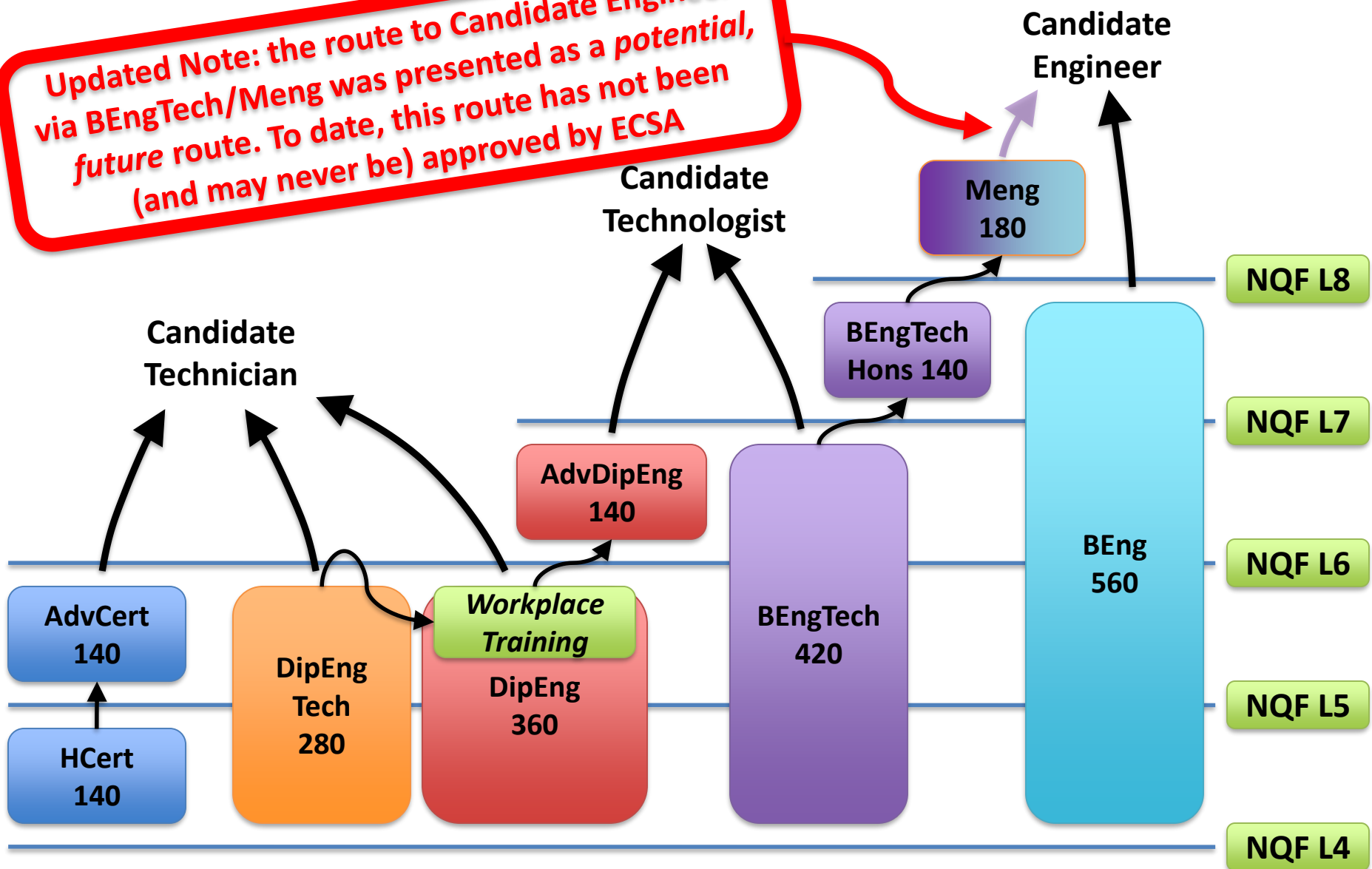
How do you train a technologist?

Compared to the Technician:

More science and mathematics

Emphasis on problem solving and design

Balance theoretical knowledge with applied

Beyond established standards and codes

Compared to the Engineer:

More hands-on and practical focus

Less front-loading of science and mathematics

Balance theoretical knowledge with applied

More direct industry contact and relevance

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Compared to the Techni...

More science ...

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...but not "Dip(Eng) plus"

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More hands-on and pract...

Less front-load... ...mathematics

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...but not "BEng lite"

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Universities of Technology Staff Profile

Academic Staff - August 2015

	Institution												
	CPUT	CUT	DUT (D)	DUT (P)	MUT	NMMU	TUT	UJ	UNISA	VUT	WSU		
Number of Approved Posts	35	16	15	10	15	8	23	10	10	17		159	
Number of Vacancies	5	4	1	5	0	1	2	2	3	8		31	
Average Headcount	1400	1000	950	650	700	230	1250	550	1800	700		19.50	*% vacant*
Staff/Student Ratio (all posts filled)	40.00	62.50	63.33	65.00	46.67	28.75	54.35	55.00	180.00	41.18			
Staff/Student Ratio (current)	46.67	83.33	67.86	130.00	46.67	32.86	59.52	68.75	257.14	77.78			
Scarce Skills Intervention	x	x	10% of salary (ECSA reg)	10% of salary (ECSA reg)	x	20% of salary	x	x	10% as part of package	x	x		
Institution Pays for ECSA	√	√	x	x	√	√	√	√	√	√	√		
Institution pays for SAICE	√	√	√	√	√	√	√	√	√	√	√		
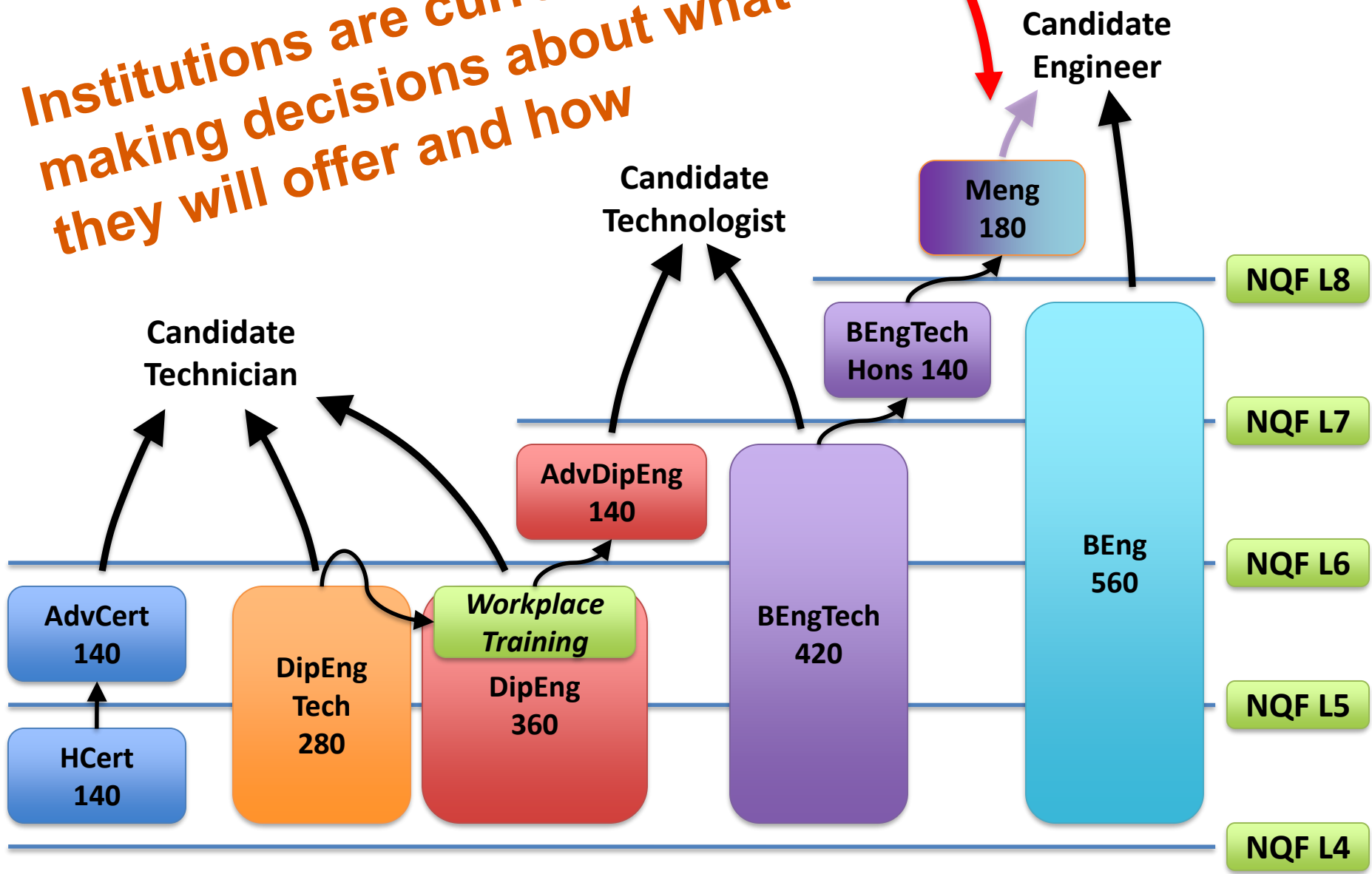
UoTs: QUALIFICATIONS OFFERED

August 2015

Present	Institution										
	CPUT	CUT	DUT (D)	DUT (P)	MUT	NMMU	TUT	UJ	UNISA	VUT	WSU
N.Diploma	√	√	√	√	√	√	√	√	√	√	√
B.Tech (Construction)	√	×	√	√	×	×	√	√	x	×	x
B.Tech (Environmental)	×	×	×	×	×	×	√	√	×	×	x
B.Tech (Geotechnical)	×	×	×	×	×	×	√	√	×	×	x
B.Tech (Structures)	×	×	√	×	×	×	√	√	√	√	x
B.Tech (Transportation)	√	√	√	√	×	√	√	√	×	√	√
B.Tech (Urban)	√	√	√	√	×	√	√	√	√	√	x
B.Tech (Water)	√	√	√	√	×	×	√	√	√	√	√
M.Tech	√	√	√	√	×	√	√	√	×	√	x
D.Tech	√	√	√	√	×	×	√	√	×	√	x

Current Nated 151 Qualifications

FUTURE	Institution										
	CPUT	CUT	DUT (D)	DUT (P)	MUT	NMMU	TUT	UJ	UNISA	VUT	WSU (I)
Certificate	√*	×	×	×	×	×	x	×	×	×	×
Higher Certificate	×	×	×	×	×	×	√*	×	x	×	×
Advanced Certificate	×	×	×	×	×	×	×	×	√	×	×
Diploma (280)	×	√	×	√	×	×	×	×	√	×	×
Diploma (360)	√	×	×	×	√	×	×	√	×	√	√
Advanced Diploma	√	×	×	√	√	×	×	×	√	√	√
Post Graduate Diploma	×	×	×	×	×	×	×	×	×	√	×
Bachelor of Eng Tech (BET)	√	√	√			√	√	√	?		?
(Earliest year of first offering)	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017
Bachelor of Engineering										√	
(Earliest year of first offering)										2019	
Honours Degree	√	√	√	×	x	√	√	√	√		x
Masters Degree	√	√	√	??	x	√	√	√	√	√	x
Doctoral Degree	√	√	√	??	x	√	√	√	√	√	x

New HEQSF Qualifications

√* indicates certificate to be used as alternative access route in association with TVET's

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BACHELOR OF CIVIL ENGINEERING TECHNOLOGY

YEAR 1

CRITERIA	SEMESTER 1	CREDITS
1	MATHS 1A	14
2	BASIC SCIENCE (APPLIED MECHANICS) 1A	14
6	COMMINUCATION SKILLS 1A	7
5	COMPUTER SKILLS 1A	7
3	DRAWING 1A	7
7	CITIZENSHIP	7
3	SURVEY 1A	7
2	STATISTICS 1A	7
		70

CRITERIA	SEMESTER2	CREDITS
1	MATHS 1B	14
2	SCIENCE 1B (FLUID MECHANICS)	7
2	GEOLOGY 1B	7
5	COMPUTER AIDED DRAWING 1B	7
6	MANAGEMENT 1B	7
3	THEORY OF STRUCTURES 1B	14
3	SURVEY 1B	7
3	CONSTRUCTION METHODS AND SAFETY 1B	7
		70

YEAR 2

CRITERIA	SEMESTER 3	CREDITS
1	MATHS 2A	14
3	GEOTECHNICAL ENGINEERING 2A	14
6	MANAGEMENT (HUMAN CAPITAL) 2A	7
3	CONCRETE TECHNOLOGY 2A	14
3	TRANSPORTATION ENGINEERING 2A	14
3	HYDRAULICS 2A	14
		77

CRITERIA	SEMESTER 4	CREDITS
1	MATHS 2B (COMPUTATIONAL MATH)	14
3	GEOTECHNICAL ENGINEERING 2B	14
6	DOCUMENTATION 2B	7
3	STRUCTURAL ANALYSIS 2B	14
3	TRANSPORTATION ENGINEERING 2B	14
3	HYDROLOGY 2B	14
		77

CIVIL COURSE (ELECTIVE OPTION)

CRITERIA	SEMESTER 5	CREDITS
4	WATER RETICULATION DESIGN 3A	14
6	CONTRACT MANAGEMENT 3A	14
4	INTRO REINFORCED CONCRETE & STE	14
3	TRANSPORTATION 3A	14
6	PROJECT MANAGEMENT 3A	14
		70

CRITERIA	SEMESTER 6	CREDITS
7	PRINCIPLES OF SUSTAINABILITY 3B	14
7	ETHICS AND COMMUNITY STUDIES 3B	7
3	WATER & WASTE WATER ENGINEERIN	14
5	COMPUTER AIDED DESIGN CIVIL 3B	14
4	CAPSTONE DESIGN PROJECT 3B	28
		77

COMMON SUBJECTS FOR ELECTIVE OPTIONS

	ECSA prescribed type of credit	CREDITS	ECSA
1	MATHS	56	42
2	BASIC SCIENCE	35	28
3	ENGINEERING SCIENCE	182	140
4	ENGINEERING DESIGN	56	49
5	COMPUTER/CAD	28	21
6	COMPLIMENTARY A	56	14
7	COMPLIMENTARY B	28	14
	TOTAL CREDITS	441	

YEAR 3

STRUCTURAL COURSE (ELECTIVE OPTION)

CRITERIA	SEMESTER 5	CREDITS
4	REINFORCED CONCRETE 3A	14
4	STRUCTURAL STEEL 3A	14
4	TIMBER AND MASONRY DESIGN 3A	14
3	STRUCTURAL ANALYSIS 3A	14
6	PROJECT MANAGEMENT 3A	14
		70

CRITERIA	SEMESTER 6	CREDITS
7	PRINCIPLES OF SUSTAINABILITY 3B	14
7	ETHICS AND COMMUNITY STUDIES 3B	7
4	PRESTRESSED CONCRETE 3B	14
3	STRUCTURAL ANALYSIS 3B	14
5	COMPUTER AIDED DESIGN STRUCT 3B	14
4	CAPSTONE DESIGN PROJECT 3B	14
		77

	ECSA prescribed type of credit	CREDITS
1	MATHS	56
2	BASIC SCIENCE	35
3	ENGINEERING SCIENCE	182
4	ENGINEERING DESIGN	70
5	COMPUTER/CAD	28
6	COMPLIMENTARY A	42
7	COMPLIMENTARY B	28
	TOTAL CREDITS	441

YEAR 3

Comparison of Engineering Qualifications

Table 1: Minimum credits in knowledge areas

	Diploma	BET	BEng
Mathematical Sciences	35	42	56
Natural Sciences	28	28	56
Engineering Sciences	126	140	180
Engineering Design	28	49	72
Computing and IT	21	21	
Complementary Studies	14	28	56
Work Integrated Learning	30		
Subtotal	282	308	420
Re-allocation above areas	78	112	140
Total credits	360	420	560

Thank You