



IEA/WASHINGTON ACCORD (WA) GRADUATE ATTRIBUTES

**Workshop on Preparation for Outcome
Based Accreditation
12 December 2017**

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Outline

- Learning Outcomes
- Important Terms
- Depth of Knowledge Required
- Twelve (12) Graduate Attributes (WA)
- Eight (8) Knowledge Profile (WK)
- Seven (7) Ranges of Complex Problem Solving (WP)
- Five (5) Ranges of Complex Engineering Activities (EA)
- Internal Audit/Moderation
- Summary

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LO



- Able to comprehend requirements of Complex Problem (WP/CP) Solving and Complex Engineering Activities (EA) according to WA graduate attributes
- Able to evaluate assessments on WP/CP and EA with Knowledge Profile (WK)
- Able to verify consolidated data for PO attainment
- Able to observe moderation process

EA ~ COMMUNICATION
WP vis-à-vis Difficult

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Important Terms




- Complex Problem Solving (WP = CP)
- Complex Engineering Activities (EA)
- Graduate Attributes (WA)
- Knowledge Profile (WK)

CP-EA-WA-WK

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INTERNATIONAL ENGINEERING ALLIANCE

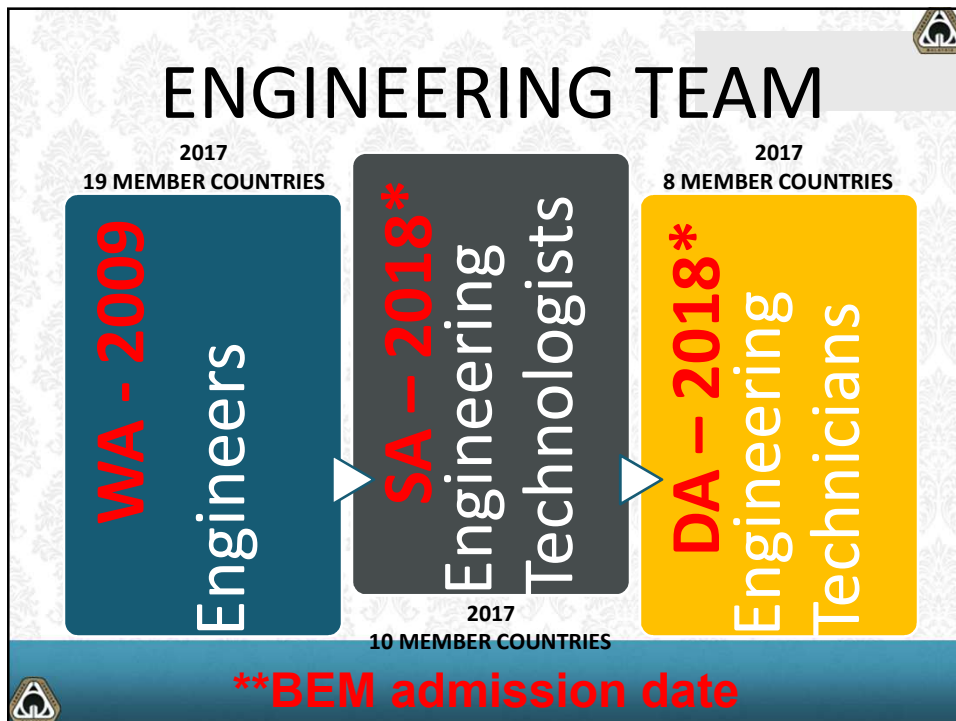
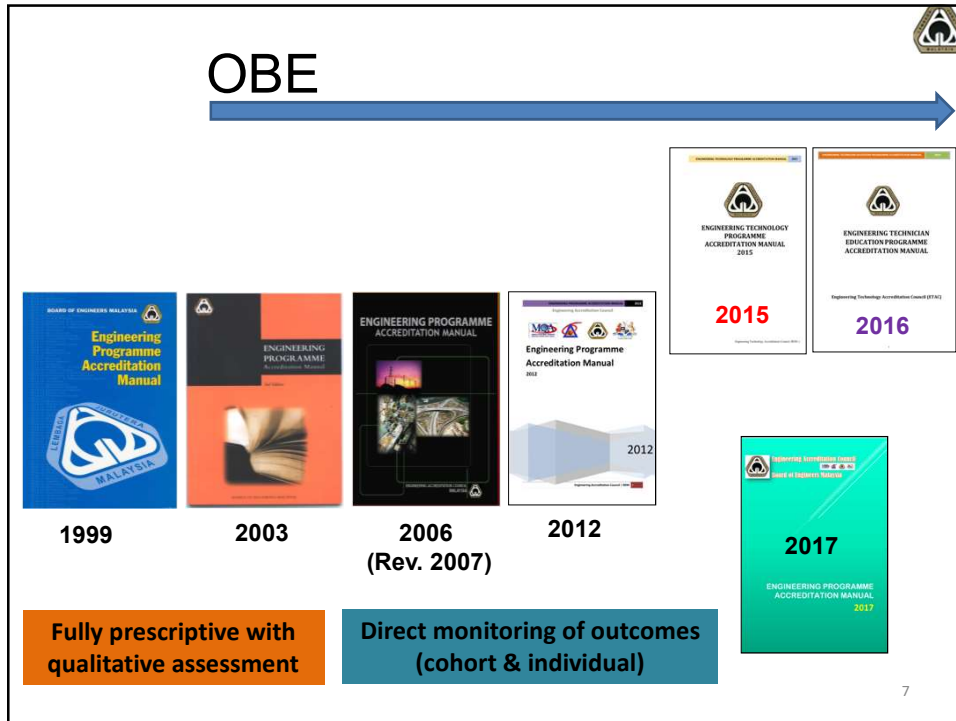
Defining standards of education and professional competence.
 (<http://www.ieagreements.org/>)
 Version 1: June 2005
 Version 2: June 2009
Version 3: June 2013

International agreements GOVERN the recognition of engineering educational qualifications and professional competence, thus establishing and enforcing internationally bench-marked standards.

EDUCATION ACCORDS	AGREEMENTS
<ul style="list-style-type: none"> • WA (19 MEMBER COUNTRIES) 1989 • SA (10 MEMBER COUNTRIES) 2001 • DA (8 MEMBER COUNTRIES) 2002 	<ul style="list-style-type: none"> • APEC • IPEA • IETA • AIET



Pre-Washington Accord Visits (2002 – 2009)		
PROVISIONAL MEMBER OF WA – 2003		
SPONSOR (UiTM, UIA) 1 st MENTOR (MMU, UKM) 2 nd MENTOR (UTeM, UTM) 3 rd MENTOR (UniMAP, UTP) 4 th MENTOR (KLIUC, UNITEN) 5 th MENTOR (UiTM) & ADM REVIEW (UPM, UKM) & ADM	UK & AUSTRALIA MENTORS AUSTRALIA – PROF BRADLEY, PROF BRISK USA – PROF FLETCHER HK – DR LEX CHAN	REVIEWERS NZ – PROF HODGSON JAPAN – PROF HONJO IRELAND – PROF GLENNON
FULL SIGNATORY MEMBER OF WA – 2009 - 2015		
REVIEW (UM. MONASH) & ADM		TAIWAN (PROF YEN) USA (PROF PATRICIA DANIELS) SOUTH AFRICA (SY GHOURRAH)
FULL SIGNATORY MEMBER OF WA – 2016 – 2021		
<ul style="list-style-type: none"> • Well documented accreditation criteria and accreditation procedures. • Comprehensive pre-visit documentation for the preparation of the Self-Evaluation Reports. • Well trained programme evaluators who are familiar with the evaluation tools and are rigorous at following the evaluation process. • Very knowledgeable EAD officials to direct the accreditation process . <ul style="list-style-type: none"> • Well-structured accreditation procedure to ensure consistency. 		



WA Member Countries



- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Australia - (EA) (1989) 2. Canada – (EC) (1989) 3. China - (CAST) (2016) 4. Chinese Taipei - (IEET) (2007) 5. Hong Kong China - (HKIE) (1995) 6. India - (NBA) (2014) 7. Ireland - (EI) (1989) 8. Japan - Represented by Japan Accreditation Board for Engineering Education (JABEE) (2005) 9. Korea - (ABEEK) (2007) 10. Malaysia - (BEM) (2009) 11. New Zealand - (IPENZ) (1989) 12. Russia - (AEER) (2012) 13. Singapore - (IES) (2006) | <ol style="list-style-type: none"> 14. South Africa - (ECSA) (1999) 15. Sri Lanka - (IESL) (2014) 16. Turkey - (MÜDEK) (2011) 17. United States - (ABET) (1989) 18. United Kingdom - (ECUK) (1989) 19. Pakistan - (PEC) (2017) <p><u>PROVISIONAL MEMBERS</u></p> <ol style="list-style-type: none"> 1. Bangladesh - (BAETE) 2. Costa Rica - (CFIA) 3. Mexico - (CACEI) 4. Peru - (ICACIT) 5. Philippines - (PTC) |
|---|--|

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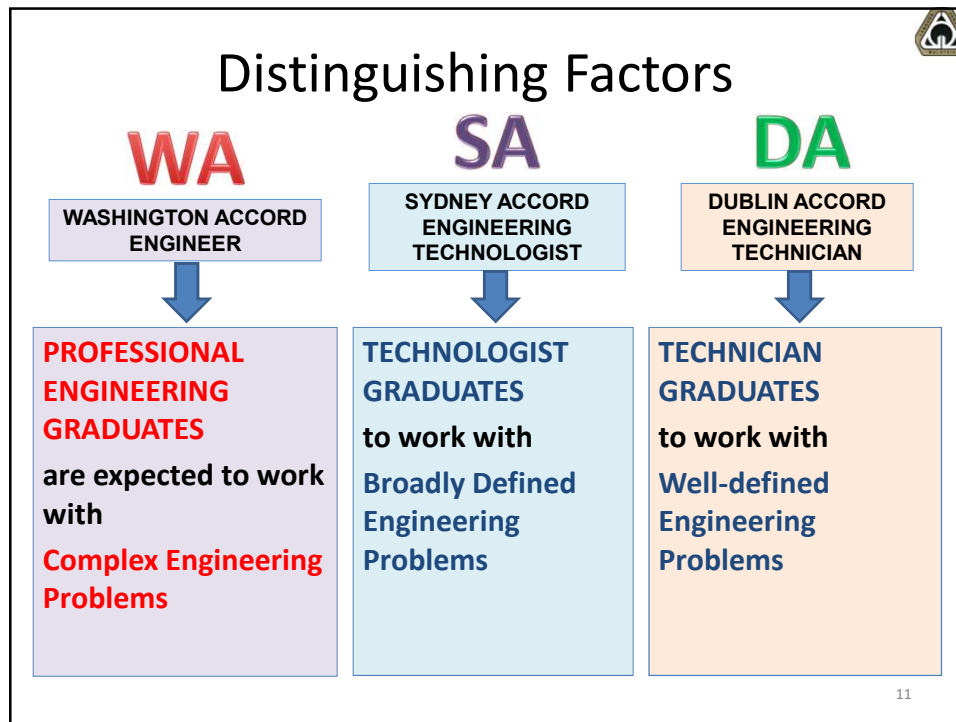
SA Member Countries

DA Member Countries




- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Australia - (EA) (2001) 2. Canada - (CCTT) (2001) 3. Chinese Taipei - (IEET) (2014) 4. Hong Kong China - (HKIE) (2001) 5. Ireland - (EI) (2001) 6. Korea - (ABEEK) (2013) 7. New Zealand - (IPENZ) (2001) 8. South Africa - (ECSA) (2001) 9. United Kingdom - (ECUK) (2001) 10. United States - (ABET) (2009) <p><u>PROVISIONAL MEMBERS</u></p> <ol style="list-style-type: none"> 1. Malaysia - (BEM) 2017* 2. Peru - (ICACIT) | <ol style="list-style-type: none"> 1. Australia - (EA) (2013) 2. Canada - (CCTT) (2002) 3. Ireland - (EI) (2002) 4. New Zealand - (IPENZ) (2013) 5. Korea - (ABEEK) (2013) 6. South Africa - (ECSA) (2002) 7. United Kingdom - (ECUK) (2002) 8. United States - (ABET) (2013) <p><u>PROVISIONAL MEMBERS</u></p> <ol style="list-style-type: none"> 1. Malaysia - (BEM) 2017* |
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KNOWLEDGE PROFILE

WA = Requires in-depth knowledge that allows a fundamentals-based first principles analytical approach	SA = Requires knowledge of principles and applied procedures or methodologies	DA = Can be solved using limited theoretical knowledge, but normally requires extensive practical knowledge
<ul style="list-style-type: none"> • WK1- natural sciences • WK2 – mathematics • WK3 – engineering fundamentals • WK4 – specialist knowledge • WK5 – engineering design • WK6 – engineering practice • WK7 – comprehension • WK8 – research literature 	<ul style="list-style-type: none"> SK1- natural sciences SK2 – mathematics SK3 – engineering fundamentals SK4 – specialist knowledge SK5 – engineering design SK6 – engineering technologies SK7 – comprehension SK8 – technological literature 	<ul style="list-style-type: none"> DK1- natural sciences DK2 – mathematics DK3 – engineering fundamentals DK4 – specialist knowledge DK5 – engineering design DK6 – practical engineering knowledge DK7 – comprehension

 WA-WK SA-SK DA-DK	PROFESSIONAL ENGINEERING GRADUATES - Complex Engineering Problems		TECHNOLOGIST GRADUATES - Broadly Defined Engineering Problems		TECHNICIAN GRADUATES - Well-Defined Engineering Problems	
	GRADUATE ATTRIBUTES (Keywords)	WA-WK's	WP/EA	SA-SK's	BD/EA	DA-DK's
1. Engineering Knowledge	WK1-WK4	WP	SK1-SK4		DK1-DK4	
2. Problem Analysis	WK1-WK4	WP	SK1-SK4	BD	DK1-DK4	WD
3. Design/Development of Solutions	WK5	WP	SK5	BD	DK5	WD
4. Investigation	WK8	WP	SK8	BD		WD
5. Modern Tool Usage	WK6	WP	SK6	BD	DK6	WD
6. The Engineer and Society	WK7	WP	SK7		DK7	
7. Environment and Sustainability	WK7	WP	SK7		DK7	
8. Ethics	WK7		SK7		DK7	
9. Individual and Team work						
10. Communication		EA		EA		EA
11. Project Management and Finance						
12. Life Long Learning						

Assessments provide adequate feedback to the programme to identify strengths and weaknesses for CQ!

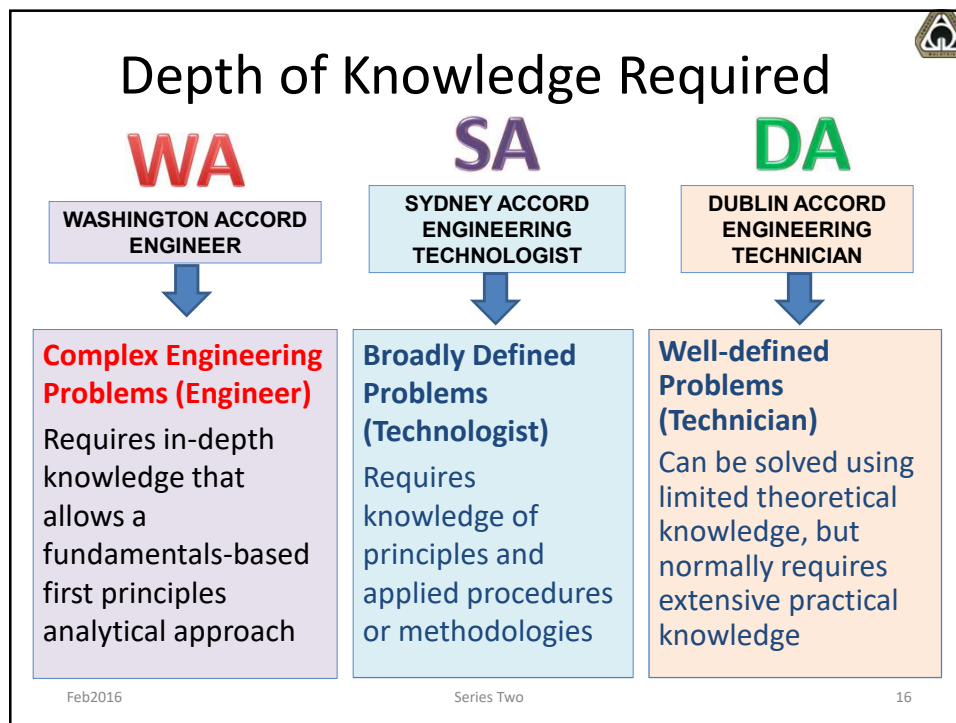
Knowledge Profile WK1-WK8 		
WK	Characteristics	
WK1	Natural sciences	A systematic, theory-based understanding of the natural sciences applicable to the discipline.
WK2	Mathematics	Conceptually-based mathematics, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modelling applicable to the discipline.
WK3	Engineering fundamentals	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4	Specialist knowledge	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

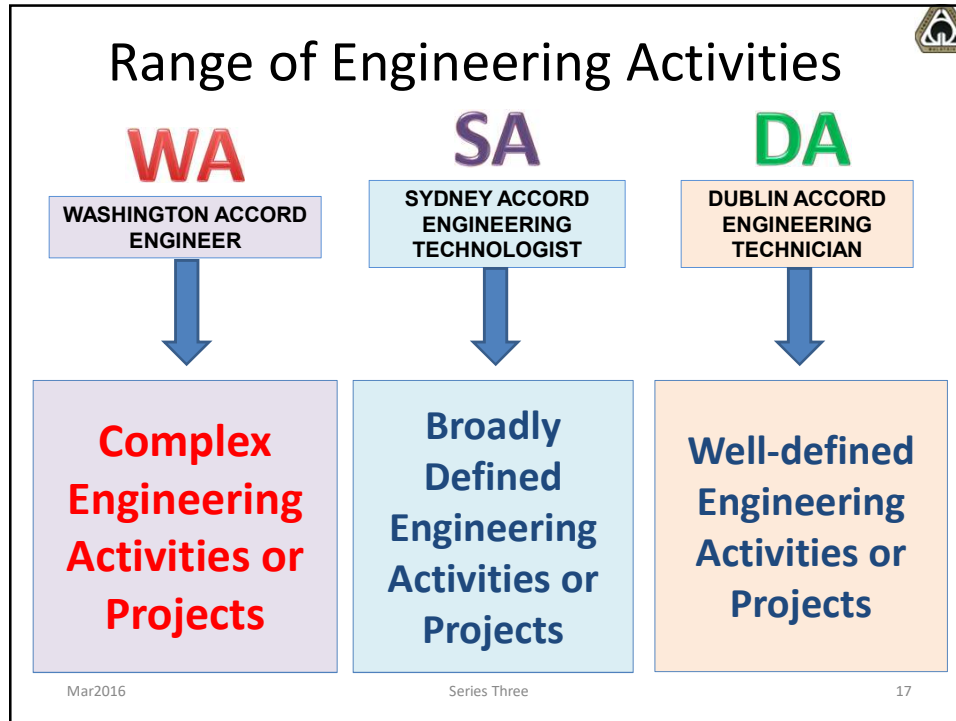
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Knowledge Profile **WK1-WK8**

WK	Characteristics	
WK5	Engineering design	Knowledge that supports engineering design in a practice area.
WK6	Engineering practice	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
WK7	Comprehension	Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the professional responsibility of an engineer to public safety; the impacts of engineering activity: economic, social, cultural, environmental and sustainability.
WK8	Research literature	Engagement with selected knowledge in the research literature of the discipline.

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Graduate Attributes WA1-WA12

WA	Characteristics		WK	WP/ EA
WA1	Engineering Knowledge	Apply mathematics, natural science, engineering fundamentals and engineering specialization to the solution of complex engineering problems	WK1, WK2, WK3, WK4	WP
WA2	Problem Analysis	Identify, formulate, research literature & analyse complex engineering problems using first principles of mathematics, natural sciences and engineering sciences	WK1, WK2, WK3, WK4	WP
WA3	Design/ Development of Solutions	Design solutions for complex engineering problems and design systems, components or processes with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	WK5	WP
WA4	Investigation	Conduct investigations of complex problems using research-based knowledge and research methods	WK8	WP


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Graduate Attributes **WA1-WA12**

WA	Characteristics		WK	WP/ EA
WA5	Modern Tool Usage	Create, select and apply modern engineering and IT tools including prediction and modelling to complex engineering problems	WK6	WP
WA6	The Engineer and Society	Apply reasoning to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems	WK7	WP
WA7	Environment and Sustainability	Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems	WK7	WP
WA8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.	WK7	-

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Graduate Attributes **WA1-WA12**

WA	Characteristics		WK	WP/ EA
WA9	Individual and Team work	Function effectively as an individual, member or leader in diverse teams and in multi-disciplinary settings	-	-
WA10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society able to comprehend, write, present, give and receive instructions	-	EA
WA11	Project Management and Finance	Demonstrate knowledge and understanding of engineering management principles and economic decision-making, apply to own work, as a member and leader in a team, manage projects and in multidisciplinary environments	-	-
WA12	Lifelong learning	Recognize the need, prepare and engage in independent and life-long learning	-	-

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Complex Engineering Problems

WP1-WP7

WP1 & some or all of WP2-WP7

Depth of knowledge required


- WP1** in-depth engineering knowledge at the level of one or more of WK3, WK4, WK5, WK6 or WK8 which allows a fundamental based, first principles analytical approach

Range of conflicting requirements

- WP2** wide-ranging or conflicting technical, engineering and other issues

Depth of analysis required

- WP3** no obvious solution and require abstract thinking, originality in analysis to formulate suitable models



Complex Engineering Problems

WP1-WP7

WP1 & some or all of WP2-WP7

Familiarity of issues

- WP4** infrequently encountered issues

Extent of applicable codes


- WP5** outside problems encompassed by standards and codes of practice for professional engineering

Extent of stakeholder involvement & conflicting requirements

- WP6** diverse groups of stakeholders with widely varying needs

Interdependence

- WP7** high level problems including many component parts or sub-problems



Complex Engineering Activities

EA1-EA5

some or all

Range of resources

- **EA1** diverse resources includes people, money, equipment, materials, information and technologies

some or all

Level of interactions

- **EA2** resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues

some or all

Innovation

- **EA3** creative use of engineering principles and research-based knowledge in novel ways

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Complex Engineering Activities

EA1-EA5

some or all

Consequences to society and the environment

- **EA4** significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation

some or all

Familiarity of issues

- **EA5** extend beyond previous experiences by applying principles-based approaches

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Internal Audit/Moderation		
Lecturer's Name		Course Code and Name
WA assigned with EA	WA10 Level of communication according to type of activities performed	
Projects/Performance/Activities with EA	(m)	%
Attributes	Some or all of the following characteristics:	
Range of resources	EA1	Yes / No & Comments :
Level of interaction	EA2	Yes / No & Comments :
Innovation	EA3	Yes / No & Comments :
Consequences to society and environment	EA4	Yes / No & Comments :
Familiarity of issues	EA5	Yes / No & Comments :
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COMPETENCY CHARACTERISTICS (Keywords)	WP/EA	BD/EA	WD/EA
1. Comprehend and apply universal knowledge	advanced	embodied	embodied
2. Comprehend and apply local knowledge	advanced	embodied	embodied
3. Problem Analysis	complex	broadly defined	well defined
4. Design/Development of Solutions	complex	broadly defined	well defined
5. Evaluation	complex	broadly defined	well defined
6. Protection of society	complex	broadly defined	well defined
7. Legal & Regulatory			
8. Ethics			
9. Manage engineering activities	complex	broadly defined	well defined
10. Communication			
11. Life long learning			
12. Judgement	complex	broadly defined	well defined
13. Responsibility for decisions	complex	broadly defined	well defined



Summary

Complex Problem Solving learning activities & Complex Engineering Activities are effective after -

- Acquire in-depth knowledge;
- Comprehend the requirements of WP/CP & EA according to WA graduate attributes and knowledge profile;
- Conduct systematic assessments on WP/CP & EA;
- Verify the moderation process; and
- WP/CP incorporated well in FYP, IDP & Design Courses and Industrial Training, whilst EA in courses assessing communication.

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Summary - EA

Complex Engineering Activities can be effectively conducted :

- Comprehend the requirements of Complex Engineering Activities (EA) according to WA graduate attributes;
- Conduct systematic assessments on EA;
- Verify the moderation process; and
- Incorporate well with courses assessing communication

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Complex Problem (WP/CP) Solving

Knowledge Sharing on Accreditation Tips : Malaysian Experience

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Complex Engineering Activities (EA)

Knowledge Sharing on Accreditation Tips : Malaysian Experience

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- EAC Manual 2012, Board of Engineers Malaysia
- IEA Graduate Attributes and Professional Competency Profiles, Version 3: 21 June 2013

Points for Clarifications

- sitihawabthamzah@gmail.com

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