



Always A Pioneer, Always Ahead



UTeM

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

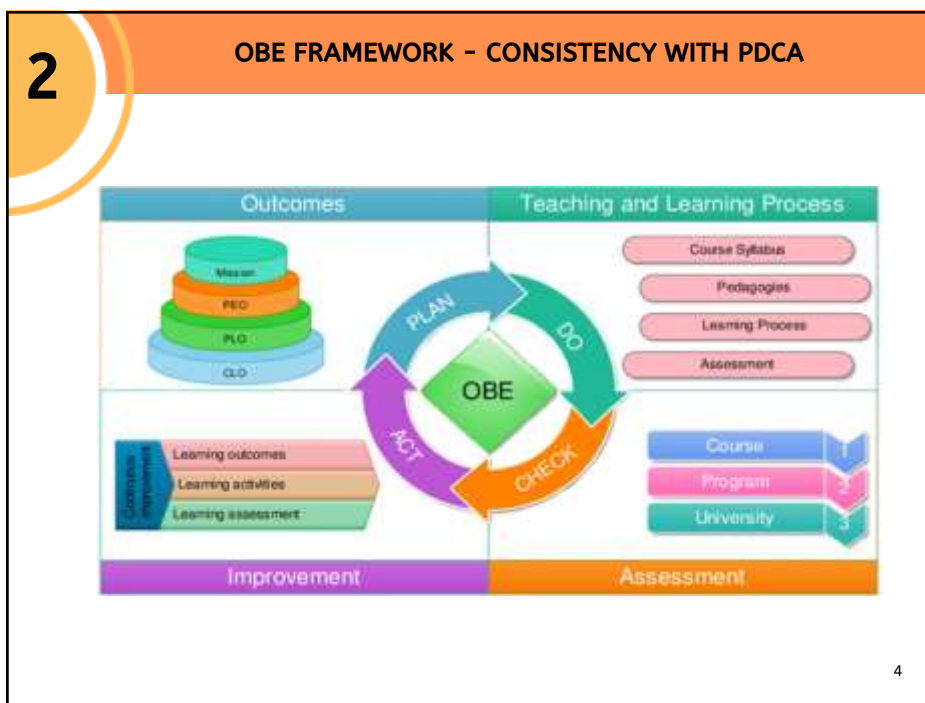
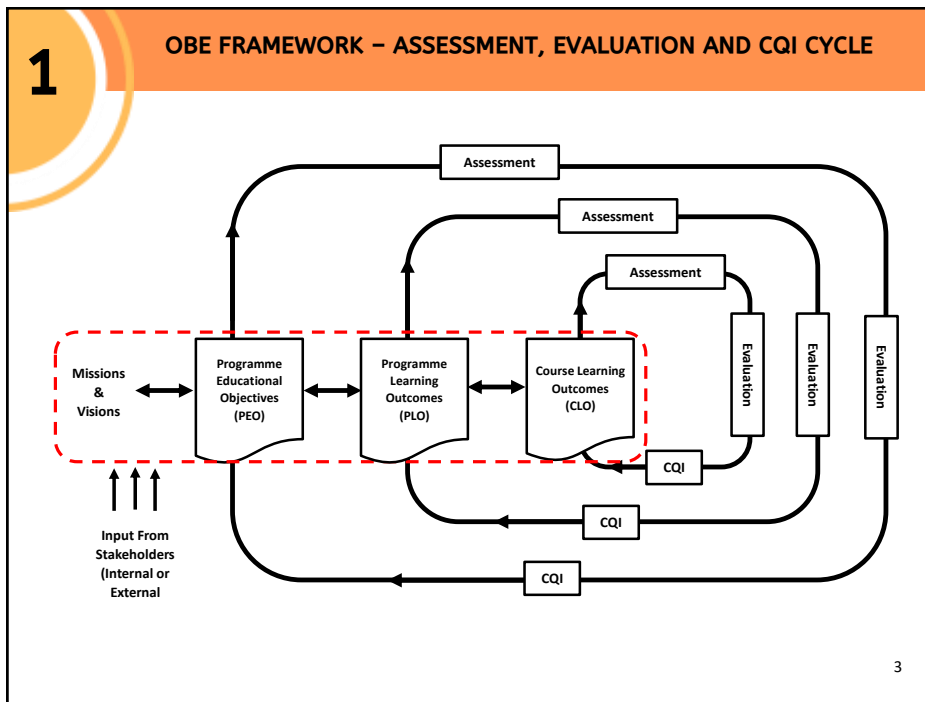
**KURSUS PEMANTAPAN OBE BERDASARKAN
PROGRAM STANDARD MQA / EAC / ETAC**




**OBE BERDASARKAN PROGRAM
STANDARD EAC / ETAC / TTAC**

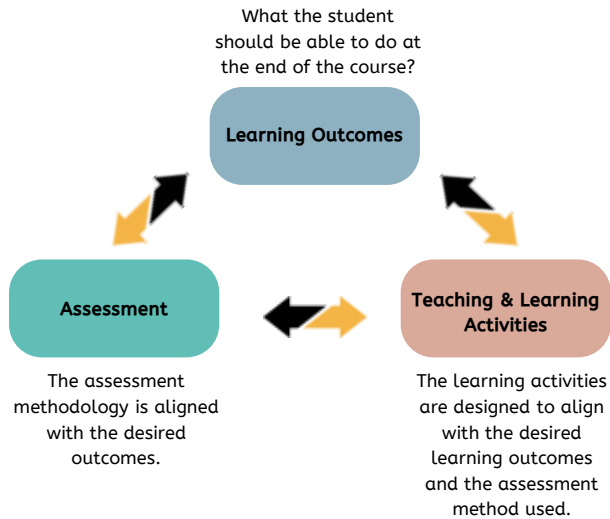
19 September 2022
Dewan UTeM 1, Kampus Teknologi, UTeM

Oleh: PM Dr. Hidayat Bin Zainuddin



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OBE PROCESS – CONSTRUCTIVE ALIGNMENT



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STANDARDS OF PROFESSIONAL BODIES



- Graduate Engineers
- Engineering Bachelor Degree Programmes
- Washington Accord



- Engineering Technologist
- Engineering Technology Bachelor Degree programmes
- Sydney Accord



- Engineering Technicians/ Inspector of Works
- Engineering Diploma and Engineering Technology Diploma programmes
- Dublin Accord

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STANDARDS OF PROFESSIONAL BODIES (Cont.)



- Technologist and Technician
- Bachelor Degree, Advanced Diploma, Diploma and Certificate Level 3 MQF
- Seoul Accord (Provisional)

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QUALIFYING REQUIREMENT

EAC

1. Outcome-based Education (OBE) implementation.

2. A minimum of 135 SLT credits* of which 90 SLT credits* must be engineering courses offered over a period of four (4) years.
3. Integrated design project (IDP).
4. Final year project (minimum six (6) credits).
5. Industrial training (minimum of eight (8) weeks).
6. Full-time academic staff (minimum of eight (8)) with at least three (3) Professional Engineers registered with the BEM or equivalent.
7. Staff: student ratio 1: 20 or better.

8. External examiner/advisor report (one in every two academic years).

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QUALIFYING REQUIREMENT

ETAC	ETeAC
1. Minimum 140 SLT* credit unit. At least 100 SLT credit units shall be engineering or engineering technology courses, of which a minimum 50 SLT credit units shall be allocated for practice-oriented components in the technical and specialist area.	1. Minimum 90 SLT* credit units. At least 60 SLT credit units shall be engineering or engineering technology courses, of which a minimum 30 SLT credit units shall be allocated for practice-oriented components in the technical and specialist area.
2. Final year project (8-12 SLT credit units)	2. Final year project (4-6 SLT credit units)
3. Industrial training (minimum of 24 weeks)	3. Industrial training (minimum of 16 weeks)
4. Full-time Teaching staff (minimum of	4. Full-time Teaching Staff (minimum of 6)
5. Staff: student ratio 1: 15 or better	5. Staff: student ratio 1: 20 or better
6. External examiner report (minimum of one report over two years)	6. External examiner report (minimum of one report over three years)
7. Programme Educational Objectives	7. Programme Educational Objectives
8. Programme Outcomes	8. Programme Outcomes

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QUALIFYING REQUIREMENT (Cont.)

TTAC													
1. Minimum total credits (min. technology component) Bachelor Degree: 120 (80)	<table border="1"> <tr> <td>Theory / Knowledge</td><td></td></tr> <tr> <td>• Technology Component only</td><td>Minimum 40%</td></tr> <tr> <td>• SLT / Credits</td><td></td></tr> <tr> <td>Practical Component</td><td></td></tr> <tr> <td>• Technology Component only</td><td>Minimum 40%</td></tr> <tr> <td>• SLT / Credits</td><td></td></tr> </table>	Theory / Knowledge		• Technology Component only	Minimum 40%	• SLT / Credits		Practical Component		• Technology Component only	Minimum 40%	• SLT / Credits	
Theory / Knowledge													
• Technology Component only	Minimum 40%												
• SLT / Credits													
Practical Component													
• Technology Component only	Minimum 40%												
• SLT / Credits													
2. Minimum duration of study Bachelor Degree: 3 years													
3. Final year project (MQF Level 4 and above)													
4. Minimum period of industrial training Bachelor Degree: 8 weeks / 6 months													
5. Minimum number of full-time teaching staff in the relevant field Bachelor Degree: 6 full-time staff													
6. Minimum staff : student ratio Bachelor Degree: 1:15 or better													
7. At least one (1) teaching staff must be a Ts. or Tc. registered under MBOT or efforts towards complying the criteria.													
8. External advisor's report													
9. Industry advisor's report													

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ACCREDITATION CRITERIA: EAC vs ETAC vs TTAC

EAC / ETAC / ETeAC Standards	TTAC Manual
Criterion 1 - Programme Educational Objectives	Criteria 1: Programme Design and Delivery
Criterion 2 - Programme Outcomes	Criteria 2: Student Assessment
Criterion 3 - Academic Curriculum	Criteria 3: Student Selection and Support Service
Criterion 4 - Students	Criteria 4: Teaching and Support Staff
Criterion 5 - Teaching and Support staff	Criteria 5: Educational Resources
Criterion 6 - Facilities	Criteria 6: Programme Management
Criterion 7 - Quality Management Systems	Criteria 7: Quality Management System

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**EAC VS ETAC ACCREDITATION CRITERIA:
OBE-RELATED PERFORMANCE INDICATORS****Criterion 1: Programme Educational Objectives**

EAC	ETAC / ETeAC
1. Define, measurable and achievable	1. Statements are well-defined, measurable and achievable
2. Linked to Programme Outcomes	2. Statements are well published and publicised
3. Have own niche	3. Clear linkage between PEO and PO
4. Published and publicised	4. Important stakeholders provide inputs in the process
5. Consistent and linked to mission & vision of IHLs and stakeholder needs	5. A documented and effective process, involving programme stakeholders for the periodic review and revision
6. Linked to curriculum design	
7. Reviewed and updated	
8. Established process for assessing and evaluating achievement of PEOs	
9. Evaluation results are used in CQI of the programme	
10. Stakeholder involvement	

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EAC VS ETAC ACCREDITATION CRITERIA: OBE-RELATED PERFORMANCE INDICATORS (Cont.)

Criterion 2: Programme Outcomes

EAC*	ETAC
1. Programme Outcomes (POs) i. Consider items in Section 6.2 (i) to (xii) in the standard ii. Linked to PEO iii. Defined, measurable and achievable iv. Detailed out and documented v. Published vi. Consistent and tied to PEO vii. Outcomes in line with national needs viii. Reviewed and updated (Continue next page)	1. Statements are well-defined, measurable and achievable. 2. Statements are well published and publicised. 3. A documented processes for assessing and evaluating the extent to which the PO are being attained has been established. 4. Results of these evaluations must be systematically utilised as input for the continuous improvement of the programmes. 5. Important stakeholders provide inputs in the process.

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EAC VS ETAC ACCREDITATION CRITERIA: OBE-RELATED PERFORMANCE INDICATORS (Cont.)

Criterion 2: Programme Outcomes

EAC
2. Processes and Results i. Processes for all elements of criteria are quantitatively/qualitatively understood and controlled ii. Processes are clearly linked to mission, PEO, and stakeholder needs iii. Systematic evaluation and process improvement in place iv. CQI involved support areas v. Processes are deployed throughout the programme, faculty, and IHLS vi. Sound and highly integrated system vii. Common sources of problems understood and eliminated viii. Sustained results ix. Results clearly caused by systematic approach 3. Stakeholders' Involvement ➤ Evidence of stakeholders' involvement with regard to (1) and (2) above. i. In defining PO statements ii. In assessing the achievement of PO iii. In assessing improvement cycles (CQI) iv. Involved in strategic partnership

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EAC VS ETAC ACCREDITATION CRITERIA: OBE-RELATED PERFORMANCE INDICATORS (Cont.)

Criterion 3: Academic Curriculum

EAC	ETAC
<p>1. Programme Structure, Course Contents, and Balance Curriculum</p> <ul style="list-style-type: none"> ➤ Engineering contents (Civil, Mechanical, Electrical, Chemical) ➤ Complex problem solving, complex engineering activities, knowledge profiles <p>Note: Refer to Appendix B in the standard of details</p> <p>2. Programme Delivery & Assessment Methods</p> <p>3. Lab, IDP, FYP and Industrial Training – concern with assessment, related PO, knowledge profile, problem solving and engineering activities.</p> <p>4. Condition For Passing Courses</p> <ul style="list-style-type: none"> ➤ The IHLs must ensure that no students shall pass a course if they fail in their examination of that course, unless the continuous assessment approach adopted can demonstrate the attainment of the depth of knowledge. 	<p>1. Programme Structure, Course Contents, and Balanced Curriculum</p> <ul style="list-style-type: none"> ➤ Broadly-define / well-defined problem solving, engineering activities, knowledge profiles <p>Note: Refer to Appendix B in the standard for details</p> <p>2. Programme Delivery & Assessment Methods</p> <p>3. Practice-Oriented Components, FYP / Design Project and Industrial Training – concern with assessment, related PO, knowledge profile, problem solving and engineering activities.</p>

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EAC VS ETAC ACCREDITATION CRITERIA: OBE-RELATED PERFORMANCE INDICATORS (Cont.)

Criterion 4: Students

EAC	ETAC
1. Observed Attainment of the Programme Outcomes by the Students	

Criterion 5: Teaching and support staff

EAC	ETAC
<p>1. Academic staff understand and implement OBE in the teaching and learning of the programme</p> <p>2. A working system for evaluation/feedback by students on matters relevant to the academic environment.</p>	

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EAC VS ETAC ACCREDITATION CRITERIA: OBE-RELATED PERFORMANCE INDICATORS (Cont.)

Criterion 7: Quality Management Systems

EAC	ETAC
1. Programme Quality Management and Planning ➤ Established system for programme planning, curriculum development, and regular review of curriculum and content	
2. External Assessment and Advisory System ➤ External Examiners and how these are being used for CQI - EE report 1 in every 2 years ➤ Industry Advisory Panel and other Relevant Stakeholders - Minutes of meeting 1 in every year	2. External Assessment and Advisory System ➤ External Examiners and how these are being used for CQI - EE report 1 in every 2 years (ETAC) / 3 years (ETeAC) ➤ Industry Advisory Panel and other Relevant Stakeholders - Minutes of meeting 1 in every year
3. Quality Assurance ➤ System for student admission and teaching and learning to assure the achievement of the programme outcomes ➤ System of assessment and evaluation of examinations, projects, industrial training, etc. including preparation and moderation of examination papers	

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TTAC ACCREDITATION CRITERIA: OBE-RELATED PERFORMANCE INDICATORS

Criteria 1 Programme Design and Delivery

1. Vision and mission of EP
2. List of PEOs with respective KPI, monitoring and evaluation mechanism.
3. Relation between PEO and EP's vision and mission
4. List of PLOs with respective KPI, monitoring and evaluation mechanism
5. Address the technology/technical services
6. Market survey and need analysis
7. Reports on programme design, review and evaluation
8. Procedures on programme design, review and evaluation
9. Adoption of various teaching-learning methods
10. Final Year Project
11. Industrial Training / Apprenticeships (Including agreement)

Criteria 2 Student Assessment

1. Mapping of assessment to PLO
2. Assessment regulation and policies, including:
 - Feedback mechanism on student performance
 - Vetting of final examination
 - External advisor input
 - Strong room regulation
 - Grading system
 - Appeal mechanism
 - Endorsement of results
 - Attainment of learning outcomes
 - Handbook on academic regulations
 - Handling of student's assessment record
3. Process on development of assessment method:
 - Process to ensure construction alignment
 - Mapping of CLO, PLO, and PEO
 - CLO assessment methods and KPI
 - CQI on CLO, PLO and PEO
4. Assessment of student course performance:
 - Final assessment
 - Coursework
 - Project (max. 4 students in a group)
 - Final year project (max. 4 students in a group)
 - Capstone project (max. 4 students in a group)
 - Industrial training

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TTAC ACCREDITATION CRITERIA: OBE-RELATED PERFORMANCE INDICATORS (Cont.)

Criteria 4 Teaching and Support Staff

1. Evaluation of teaching staff by students.

Criteria 7 Quality Management System

1. Policies and relationships between department with stakeholders in:

- Collegiality and clarity
- Finance management
- Other resources
- Programme delivery
- Research
- Consultancy

2. Stakeholders (student, alumni, employers, professional bodies, teaching staff and informed citizens) engagement/feedback to improve programme.

3. Programme advisory committee comprise of professionals, industry representatives, external academic evaluators, subject-matter experts, alumni and other relevant stakeholders.

4. Student representative feedback

5. Report on the monitoring, review and evaluation of:

- Governance
- Institutional process
- Functions and report of examination committee
- Curriculum outcomes, content, delivery and assessment
- Students performance (PLO attainment)
- Graduates achievement (PEO attainment)

6. Benchmarking on QMS conducted

7. Components of continual improvement:

- Curriculum and core courses review at least once every programme cycle
- External advisor report at least once in 2 years
- Progressive evaluation of practical and industrial attachment practices
- Calibration of equipment at regular interval
- Linkages and involvement with industry
- Dialogue session with stakeholders at least once every programme cycle
- Keynote speech in relevant field
- Active academic staff participants in conference/seminar / workshop / short course
- Organisation of conference/ seminar/ workshop

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PROGRAM OUTCOMES (PO) OR GRADUATE ATTRIBUTE PROFILES (WA / SA / DA)

- 12 POs based on current EAC / ETAC standards

	EAC (WA)	ETAC (SA)	ETeAC (DA)
PO1 - Engineering Knowledge	Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialisation to the solution of complex engineering problems (WK1 to WK4)	Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialisation to defined and applied engineering procedures, processes, systems or methodologies (SK1 to SK4)	Apply knowledge of applied mathematics, applied science, engineering fundamentals and an engineering specialisation to wide practical procedures and practices (DK1 to DK4)
PO2 - Problem Analysis	Identify, formulate, conduct research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences (WK1 to WK4)	Identify, formulate, research literature and analyse broadly-defined engineering problems reaching substantiated conclusions using analytical tools appropriate to their discipline or area of specialisation (SK1 to SK4)	Identify and analyse well-defined engineering problems reaching substantiated conclusions using codified methods of analysis specific to their field of activity (DK1 to DK4)

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PROGRAM OUTCOMES (PO) OR GRADUATE ATTRIBUTE PROFILES (WA / SA / DA)

	EAC (WA)	ETAC (SA)	ETeAC (DA)
PO3 - Design/ Development of Solutions	Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations (WK5)	Design solutions for broadly-defined engineering technology problems and contribute to the design of systems, components or processes to meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations (SK5)	Design solutions for well-defined technical problems and assist with the design of systems, components or processes to meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations (DK5)
PO4 - Investigation	Conduct investigation of complex engineering problems using research-based knowledge and research methods, including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions (WK8)	Conduct investigations of broadly-defined problems ; locate, search and select relevant data from codes, data bases and literature, design and conduct experiments to provide valid conclusions (SK8)	Conduct investigations of well-defined problems ; locate and search relevant codes and catalogues, conduct standard tests and measurements

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PROGRAM OUTCOMES (PO) OR GRADUATE ATTRIBUTE PROFILES (WA / SA / DA)

	EAC (WA)	ETAC (SA)	ETeAC (DA)
PO5 - Modern Tool Usage	Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems , with an understanding of the limitations (WK6)	Select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to broadly-defined engineering problems , with an understanding of the limitations (SK6)	Apply appropriate techniques, resources, and modern engineering and IT tools to well-defined engineering problems , with an awareness of the limitations (DK6)
PO6 - The Engineer and Society	Apply reasoning informed by contextual knowledge 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)	Demonstrate understanding of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering technology practice and solutions to broadly-defined engineering problems (SK7)	Demonstrate knowledge of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering technician practice and solutions to well-defined engineering problems (DK7)

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PROGRAM OUTCOMES (PO) OR GRADUATE ATTRIBUTE PROFILES (WA / SA / DA)

	EAC (WA)	ETAC (SA)	ETeAC (DA)
PO7 - Environment and Sustainability	Understand and evaluate the sustainability and impact of professional engineering work in the solutions of complex engineering problems in societal and environmental contexts (WK7)	Understand the impact of engineering technology solutions of broadly-defined engineering problems in societal and environmental context and demonstrate knowledge of and need for sustainable development (SK7)	Understand and evaluate the sustainability and impact of engineering technician work in the solution of well-defined engineering problems in societal and environmental contexts (DK7)
PO8 - Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice (WK7)	Understand and commit to professional ethics and responsibilities and norms of engineering technology practice (SK7)	Understand and commit to professional ethics and responsibilities and norms of technician practice (DK7)
PO9 - Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings	Function effectively as an individual, and as a member or leader in diverse technical teams	Function effectively as an individual, and as a member in diverse technical teams

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PROGRAM OUTCOMES (PO) OR GRADUATE ATTRIBUTE PROFILES (WA / SA / DA)

	EAC (WA)	ETAC (SA)	ETeAC (DA)
PO10 - Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions	Communicate effectively on broadly-defined engineering activities with the engineering community and with society at large, by being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions	Communicate effectively on well-defined engineering activities with the engineering community and with society at large, by being able to comprehend the work of others, document their own work, and give and receive clear instructions
PO11 - Project Management and Finance	Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects in multidisciplinary environments	Demonstrate knowledge and understanding of engineering management principles and apply these to one's own work, as a member or leader in a team and to manage projects in multidisciplinary environments	Demonstrate knowledge and understanding of engineering management principles and apply these to one's own work, as a member or leader in a technical team and to manage projects in multidisciplinary environments

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PROGRAM OUTCOMES (PO) OR GRADUATE ATTRIBUTE PROFILES (WA / SA / DA)

	EAC (WA)	ETAC (SA)	ETeAC (DA)
PO12 - Life Long Learning	Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	Recognize the need for, and have the ability to engage in independent and life-long learning in specialist technologies	Recognise the need for, and have the ability to engage in independent updating in the context of specialised technical knowledge

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PROGRAM OUTCOMES (PO) OR GRADUATE ATTRIBUTE PROFILES (WA / SA / DA)

New standard is expected to be available soon:

- 11 POs – to combine PO6 and PO7
- Consideration of 17 UN Sustainable Development Goals (UN-SDG) in some POs

Example:

INTERNATIONAL ENGINEERING ALLIANCE			
Differentiating Characteristics	Engineer Graduate	Engineering Technologist Graduate	Engineering Technician Graduate
Investigation: Breadth and depth of investigation and experimentation	WA4: Conduct investigations of complex engineering problems using research methods including research-based knowledge, design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions (WR2)	SA4: Conduct investigations of broadly-defined engineering problems; locate, search and select relevant data from codes, data bases and literature, design and conduct experiments to provide valid conclusions (SR2)	DA4: Conduct investigations of well-defined problems; locate and search relevant codes and catalogues, conduct standard tests and measurements (DR2)
Tool Usage: Level of understanding of the appropriateness of technologies and tools	WA5: Create, select and apply, and recognize limitations of appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems (WR2 and WR3)	SA5: Select and apply, and recognize limitations of appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to broadly-defined engineering problems (SR2 and SR3)	DA5: Apply appropriate techniques, resources, and modern computing, engineering, and IT tools to well-defined engineering problems, with an awareness of the limitations. (DR2 and DR3)
The Engineer and the World: Level of knowledge and responsibility for sustainable development	WA6: When solving complex engineering problems, analyse and evaluate sustainable development impacts* to: society, the economy, sustainability, health and safety, legal frameworks, and the environment (WR1, WR5, and WR7)	SA6: When solving broadly-defined engineering problems, analyse and evaluate sustainable development impacts* to: society, the economy, sustainability, health and safety, legal frameworks, and the environment (SR1, SR5, and SR7)	DA6: When solving well-defined engineering problems, evaluate sustainable development impacts* to: society, the economy, sustainability, health and safety, legal frameworks, and the environment (DR1, DR5, and DR7)
Ethics: Understanding and level of practice	WA7: Apply ethical principles and commit to professional ethics and norms of engineering practice and	SA7: Understand and commit to professional ethics and norms of engineering technologist practice	DA7: Understand and commit to professional ethics and norms of technician practice including:

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KNOWLEDGE PROFILE (WK / SK / DK)

	EAC (WA)	ETAC (SA)	ETeAC (DA)
Natural Sciences	WK1 - A systematic, theory-based understanding of the <u>natural sciences</u> applicable to the discipline.	SK1 - A systematic, theory-based understanding of the <u>natural sciences</u> applicable to the sub-discipline.	DK1 - A descriptive, formula-based understanding of the <u>natural sciences</u> applicable in a sub-discipline.
Mathematics	WK2 - Conceptually-based <u>mathematics</u> , numerical analysis, statistics and formal aspects of computer and information science to support analysis and modelling applicable to the discipline.	SK2 - Conceptually-based <u>mathematics</u> , numerical analysis, statistics and aspects of computer and information science to support analysis and use of models applicable to the sub-discipline.	DK2 - Procedural <u>mathematics</u> , numerical analysis, statistics applicable in a subdiscipline.
Engineering Fundamentals	WK3 - A systematic, theory-based formulation of <u>engineering fundamentals</u> required in the engineering discipline.	SK3 - A systematic, theory-based formulation of <u>engineering fundamentals</u> required in an accepted sub-discipline.	DK3 - A coherent procedural formulation of <u>engineering fundamentals</u> required in an accepted sub-discipline.

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KNOWLEDGE PROFILE (WK / SK / DK)

	EAC (WA)	ETAC (SA)	ETeAC (DA)
Engineering Specialist Knowledge	WK4 - <u>Engineering specialist knowledge</u> 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.	SK4 - <u>Engineering specialist knowledge</u> that provides theoretical frameworks and bodies of knowledge for an accepted sub-discipline.	DK4 - <u>Engineering specialist knowledge</u> that provides the body of knowledge for an accepted sub-discipline.
Engineering Design	WK5 - Knowledge that supports <u>engineering design</u> in a practice area.	SK5 - Knowledge that supports <u>engineering design</u> using the technologies of a practice area.	DK5 - Knowledge that supports <u>engineering design</u> based on the techniques and procedures of a practice area.
Engineering Practice / Engineering Technologies / Practical Engineering Knowledge	WK6 - Knowledge of <u>engineering practice</u> (technology) in the practice areas in the engineering discipline.	SK6 - Knowledge of <u>engineering technologies</u> applicable in the sub-discipline.	DK6 - Codified <u>practical engineering knowledge</u> in recognised practice area.

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KNOWLEDGE PROFILE (WK / SK / DK)

	EAC (WA)	ETAC (SA)	ETeAC (DA)
Comprehension / Knowledge	WK7 - <u>Comprehension</u> 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.	SK7 - <u>Comprehension</u> of the role of technology in society and identified issues in applying engineering technology: ethics and impacts: economic, social, environmental and sustainability.	DK7 - <u>Knowledge</u> of issues and approaches in engineering technician practice: ethics, financial, cultural, environmental and sustainability impacts.
Research Literature / Technological Literature	WK8 - Engagement with selected knowledge in the <u>research literature</u> of the discipline.	SK8 - Engagement with the <u>technological literature</u> of the discipline.	NA

☐ New knowledge profiles are to be available soon (up to WK9 / SK9 / DK9)

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RANGE OF PROBLEM IDENTIFICATION AND SOLVING (WP / SP / DP)

ATTRIBUTES	EAC (WA)	ETAC (SA)	ETeAC (DA)
Complex Problems have characteristic WP1 and some or all of WP2 to WP7	Complex Problems have characteristic WP1 and some or all of WP2 to WP7	Broadly-defined Problems have characteristic SP1 and some or all of SP2 to SP7	Well-defined Problems have characteristic DP1 and some or all of DP2 to DP7
Depth of Knowledge Required	WP1 - Cannot be resolved without 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.	SP1 - Cannot be resolved without engineering knowledge at the level of one or more of SK 4, SK5, and SK6 supported by SK3 with a strong emphasis on the application of developed technology.	DP1 - Cannot be resolved without extensive practical knowledge as reflected in DK5 and DK6 supported by theoretical knowledge defined in DK3 and DK4.

Compulsory

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RANGE OF PROBLEM IDENTIFICATION AND SOLVING (WP / SP / DP)

ATTRIBUTES	EAC (WA)	ETAC (SA)	ETeAC (DA)
	Complex Problems have characteristic WP1 and some or all of WP2 to WP7	Broadly-defined Problems have characteristic SP1 and some or all of SP2 to SP7	Well-defined Problems have characteristic DP1 and some or all of DP2 to DP7
Range of conflicting requirements	WP2 - Involve wide-ranging or conflicting technical, engineering and other issues.	SP2 - Involve a variety of factors which may impose conflicting constraints.	DP2 - Involve several issues, but with few of these exerting conflicting constraints.
Depth of analysis required	WP3 - Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models.	SK3 - Can be solved by application of well-proven analysis techniques.	DK3 - Involve several issues, but with few of these exerting conflicting constraints.
Familiarity of issues	WP4 - Involve infrequently encountered issues.	SK4 - Belong to families of familiar problems which are solved in well-accepted ways.	DK4 - Are frequently encountered and thus familiar to most practitioners in the practice area.
Extent of applicable codes	WP5 - Are outside problems encompassed by standards and codes of practice for professional engineering.	SK5 - May be partially outside those encompassed by standards or codes of practice.	DK5 - Are encompassed by standards and/or documented codes of practice.

At least TWO

Cont.

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RANGE OF PROBLEM IDENTIFICATION AND SOLVING (WP / SP / DP)

ATTRIBUTES	EAC (WA)	ETAC (SA)	ETeAC (DA)
	Complex Problems have characteristic WP1 and some or all of WP2 to WP7	Broadly-defined Problems have characteristic SP1 and some or all of SP2 to SP7	Well-defined Problems have characteristic DP1 and some or all of DP2 to DP7
Extent of stakeholder involvement and level of conflicting requirements	WP6 - Involve diverse groups of stakeholders with widely varying needs.	SK6 - Involve several groups of stakeholders with differing and occasionally conflicting needs.	DK6 - Are encompassed by standards and/or documented codes of practice.
Interdependence	WP7 - Are high level problems including many component parts or sub-problems.	SK7 - Are parts of, or systems within complex engineering problems.	DK7 - Are discrete components of engineering systems.

Cont.

At least TWO

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RANGE OF ENGINEERING ACTIVITIES (EA / TA / NA)

ATTRIBUTES	EAC (WA)	ETAC (SA)	ETeAC (DA)
	Complex activities means (engineering) activities or projects that have some or all of the following characteristics:	Broadly-defined activities means (engineering) activities or projects that have some or all of the following characteristics:	Well-defined activities means (engineering) activities or projects that have some or all of the following characteristics:
Range of resources	EA1 - Involve the use of diverse resources (and for this purpose resources includes people, money, equipment, materials, information and technologies).	TA1 - Involve a variety of resources (and for this purposes resources includes people, money, equipment, materials, information and technologies).	NA1 - Involve a limited range of resources (and for this purpose resources includes people, money, equipment, materials, information and technologies).
Level of interactions	EA2 - Require resolution of significant problems arising from interactions between wide ranging or conflicting technical, engineering or other issues.	TA2 - Require resolution of occasional interactions between technical, engineering and other issues, of which few are conflicting.	NA2 - Require resolution of interactions between limited technical and engineering issues with little or no impact of wider issues.

At least TWO

Cont.

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RANGE OF ENGINEERING ACTIVITIES (EA / TA / NA)

ATTRIBUTES	EAC (WA)	ETAC (SA)	ETeAC (DA)
	Complex activities means (engineering) activities or projects that have some or all of the following characteristics:	Broadly-defined activities means (engineering) activities or projects that have some or all of the following characteristics:	Well-defined activities means (engineering) activities or projects that have some or all of the following characteristics:
Innovation	EA3 - Involve creative use of engineering principles and research-based knowledge in novel.	TA3 - Involve the use of new materials, techniques or processes in non-standard ways.	NA3 - Involve the use of existing materials techniques, or processes in modified or new ways.
Consequences to society and the environment	EA4 - Have significant consequences in a range of contexts, characterised by difficulty of prediction and mitigation.	TA4 - Have reasonably predictable consequences that are most important locally, but may extend more widely.	NA4 - Have consequences that are locally important and not far-reaching.
Familiarity	EA5 - Can extend beyond previous experiences by applying principles-based approaches.	TA5 - Require a knowledge of normal operating procedures and processes.	NA5 - Require a knowledge of practical procedures and practices for widely-applied operations and processes.

Cont.

At least TWO

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Relationship Between Programme Outcomes, Knowledge Profile, Problem Solving and Engineering Activities (PO-WK-WP-EA)

Programme Outcomes (PO) / Graduate Attributes (WA)	EAC	
	Knowledge Profile (WK)	Complex Problems (WP) / Engineering Activities (EA)
PO1 - Engineering Knowledge	WK1 - Natural Sciences WK2 - Mathematics WK3 - Engineering Fundamentals WK4 - Engineering Specialist Knowledge	WP1 - Depth of Knowledge Required + Any TWO or more of the following: WP2 - Range of conflicting requirements WP3 - Depth of analysis required WP4 - Familiarity of issues WP5 - Extent of applicable codes WP6 - Extent of stakeholder involvement and level of conflicting requirements WP7 - Interdependence
PO2 - Problem Analysis	WK1 - Natural Sciences WK2 - Mathematics WK3 - Engineering Fundamentals WK4 - Engineering Specialist Knowledge	
PO3 - Design/ Development of Solutions	WK5 - Engineering Design.	
PO4 - Investigation	WK8 - Research Literature	
PO5 - Modern Tool Usage	WK6 - Engineering Practice	
PO6 - The Engineer and Society	WK7 - Comprehension	
PO7 - Environment and Sustainability	WK7 - Comprehension	

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Relationship Between Programme Outcomes, Knowledge Profile, Problem Solving and Engineering Activities (PO-WK-WP-EA)

Programme Outcomes (PO) / Graduate Attributes (WA)	EAC	
	Knowledge Profile (WK)	Complex Problems (WP) / Engineering Activities (EA)
PO8 - Ethics	WK7 - Comprehension	-
PO9 - Individual and Team Work	-	-
PO10 - Communication	-	Any TWO or more of the following: EA1 - Range of resources EA2 - Level of interactions EA3 - Innovation EA4 - Consequences to society and the environment EA5 - Familiarity
PO11 - Project Management and Finance	-	-
PO12 - Life Long Learning	-	-

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Relationship Between Programme Outcomes, Knowledge Profile, Problem Solving and Engineering Activities (PO-SK-SP-TA)

Programme Outcomes (PO) / Graduate Attributes (SA)	ETAC	
	Knowledge Profile (SK)	Broadly-Defined Problems (SP) / Engineering Activities (TA)
PO1 - Engineering Knowledge	SK1 - Natural Sciences SK2 - Mathematics SK3 - Engineering Fundamentals SK4 - Engineering Specialist Knowledge	SP1 - Depth of Knowledge Required + Any TWO or more of the following: SP2 - Range of conflicting requirements SP3 - Depth of analysis required SP4 - Familiarity of issues SP5 - Extent of applicable codes SP6 - Extent of stakeholder involvement and level of conflicting requirements SP7 - Interdependence
PO2 - Problem Analysis	SK1 - Natural Sciences SK2 - Mathematics SK3 - Engineering Fundamentals SK4 - Engineering Specialist Knowledge	
PO3 - Design/ Development of Solutions	SK5 - Engineering Design.	
PO4 - Investigation	SK8 - Research Literature	
PO5 - Modern Tool Usage	SK6 - Engineering Practice	
PO6 - The Engineer and Society	SK7 - Comprehension	
PO7 - Environment and Sustainability	SK7 - Comprehension	

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Relationship Between Programme Outcomes, Knowledge Profile, Problem Solving and Engineering Activities (PO-SK-SP-TA)

Programme Outcomes (PO) / Graduate Attributes (SA)	ETAC	
	Knowledge Profile (SK)	Broadly-Defined Problems (SP) / Engineering Activities (TA)
PO8 - Ethics	SK7 - Comprehension	-
PO9 - Individual and Team Work	-	-
PO10 - Communication	-	Any TWO or more of the following: TA1 - Range of resources TA2 - Level of interactions TA3 - Innovation TA4 - Consequences to society and the environment TA5 - Familiarity
PO11 - Project Management and Finance	-	-
PO12 - Life Long Learning	-	-

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Relationship Between Programme Outcomes, Knowledge Profile, Problem Solving and Engineering Activities (PO-DK-DP-NA)

Programme Outcomes (PO) / Graduate Attributes (DA)	ETeAC	
	Knowledge Profile (DK)	Well-Defined Problems (DP) / Engineering Activities (NA)
PO1 - Engineering Knowledge	DK1 - Natural Sciences DK2 - Mathematics DK3 - Engineering Fundamentals DK4 - Engineering Specialist Knowledge	DP1 - Depth of Knowledge Required +
PO2 - Problem Analysis	DK1 - Natural Sciences DK2 - Mathematics DK3 - Engineering Fundamentals DK4 - Engineering Specialist Knowledge	Any TWO or more of the following: DP2 - Range of conflicting requirements DP3 - Depth of analysis required DP4 - Familiarity of issues DP5 - Extent of applicable codes DP6 - Extent of stakeholder involvement and level of conflicting requirements DP7 - Interdependence
PO3 - Design/ Development of Solutions	DK5 - Engineering Design.	
PO4 - Investigation	-	
PO5 - Modern Tool Usage	DK6 - Engineering Practice	
PO6 - The Engineer and Society	DK7 - Comprehension	
PO7 - Environment and Sustainability	DK7 - Comprehension	

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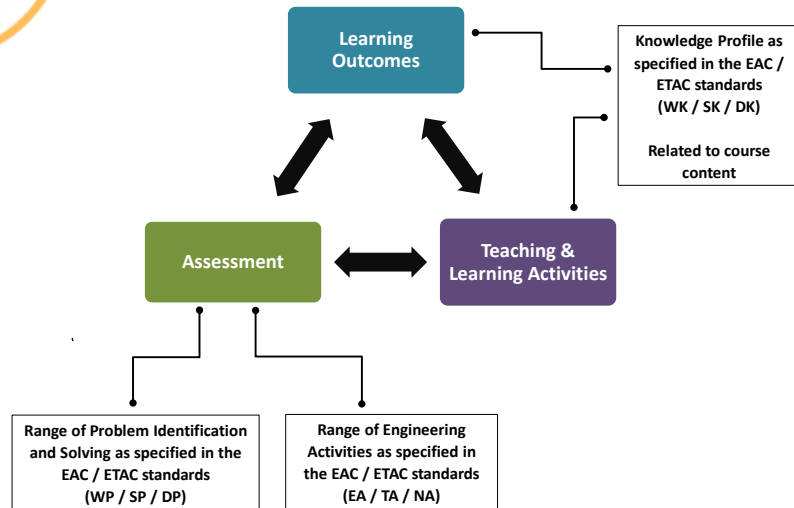
Relationship Between Programme Outcomes, Knowledge Profile, Problem Solving and Engineering Activities (PO-DK-DP-NA)

Programme Outcomes (PO) / Graduate Attributes (DA)	ETeAC	
	Knowledge Profile (SK)	Well-Defined Problems (DP) / Engineering Activities (NA)
PO8 - Ethics	DK7 - Comprehension	-
PO9 - Individual and Team Work	-	-
PO10 - Communication	-	Any TWO or more of the following: NA1 - Range of resources NA2 - Level of interactions NA3 - Innovation NA4 - Consequences to society and the environment NA5 - Familiarity
PO11 - Project Management and Finance	-	-
PO12 - Life Long Learning	-	-

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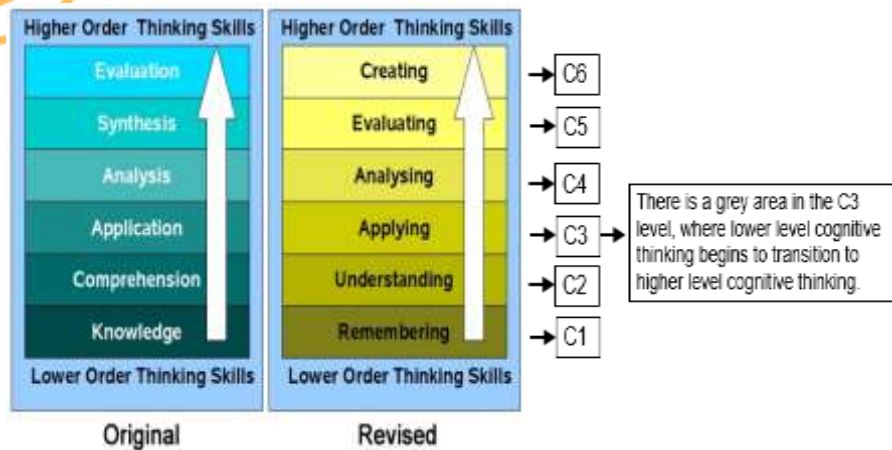
KNOWLEDGE PROFILE, PROBLEM SOLVING AND ENGINEERING ACTIVITIES IN THE OBE PROCESS



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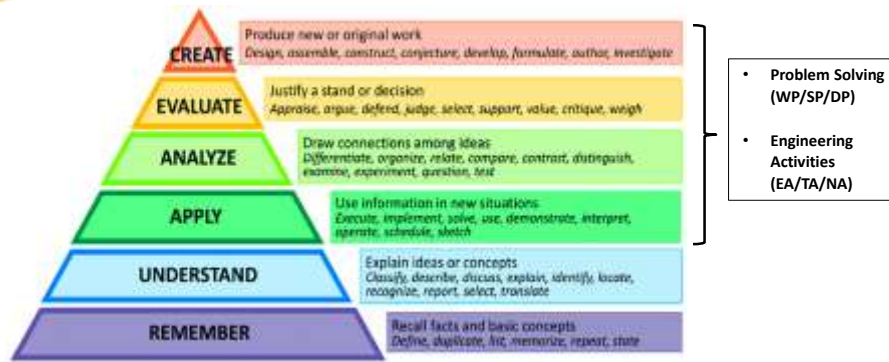
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ASSESSMENT - BLOOM'S TAXONOMY



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ASSESSMENT - IMPLEMENTATION OF PROBLEM SOLVING AND
ENGINEERING ACTIVITIES IN BLOOM'S TAXONOMY

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APPROACHES OF CONSTRUCTIVE ALIGNMENT IN CLO-PO-WK-WP-EA

1. Courses address the WK-WP-EA earlier – all or selected courses
 - ☐ Course-PO-WK-WP-EA matrix is set first
 - ☐ Then, will be followed at the course level in the assessment.
2. Flexible approach – all or selected courses
 - ☐ No fixed WP / EA to any course.
 - ☐ Lecturers have flexibility in designing the assessment considering the WP / EA based on the nature of the course.
 - ☐ CLO-PO-WK-WP-EA matrix related to assessment documents e.g. assignment, mid-term / final exam, moderation forms, etc.

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APPROACHES OF CONSTRUCTIVE ALIGNMENT IN CLO-PO-WK-WP-EA

Course-PO-WK-WP-EA matrix

	Programme Outcomes & Knowledge Profile												Complex Problem Solving						Engineering Activities																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
	PO1			PO2			PO3			PO4			PO5			PO6			PO7			PO8			PO9			PO10			PO11			PO12			WP1			WP2			WP3			WP4			WP5			WP6			WP7			EAI			EAI2			EAI3			EAI4			EAI5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
Course 1	WS1	WS2	WS3	WS4	WS5	WS6	WS7	WS8	WS9	WS10	WS11	WS12	WS13	WS14	WS15	WS16	WS17	WS18	WS19	WS20	WS21	WS22	WS23	WS24	WS25	WS26	WS27	WS28	WS29	WS30	WS31	WS32	WS33	WS34	WS35	WS36	WS37	WS38	WS39	WS40	WS41	WS42	WS43	WS44	WS45	WS46	WS47	WS48	WS49	WS50	WS51	WS52	WS53	WS54	WS55	WS56	WS57	WS58	WS59	WS60	WS61	WS62	WS63	WS64	WS65	WS66	WS67	WS68	WS69	WS70	WS71	WS72	WS73	WS74	WS75	WS76	WS77	WS78	WS79	WS80	WS81	WS82	WS83	WS84	WS85	WS86	WS87	WS88	WS89	WS90	WS91	WS92	WS93	WS94	WS95	WS96	WS97	WS98	WS99	WS100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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ASSESSMENT EXAMPLE – EXAMINATION QUESTION

LO	PO	WP	BLOOM'S TAXONOMY
LO4 - Apply energy policies, regulation, act, energy efficient, green and renewable technologies toward energy utilization and conservation.	PO6 - The Engineer and Society Apply reasoning informed by contextual knowledge 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 - Comprehension of the role of engineering)	WP1 - Depth of Knowledge Required (WK4 - Engineering Specialist Knowledge) WP3 - Depth of analysis required WP5 - Extent of applicable codes	C3 - Apply

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ASSESSMENT EXAMPLE – ASSIGNMENT

High Voltage Engineering (BEKP 4883)

Assignment

Form a group of max 4 people (Except 1 group will have 5 members). Each group is required to write a report (max 20 pages) reviewing the condition monitoring and diagnostic testing techniques on any of the following high voltage equipment, based on the first come first serve basis:

1. Oil-filled transformer
2. Cast-resin transformer
3. Cable
4. Rotating machine (motor/generator)

Note: Grouping and topic selection will be on the ULearn.

The review should focus on a particular theme and you are required to propose a suitable title for your report. Some examples of the theme are as follows:

1. Focus on several methods of partial discharge measurement.
2. Focus on various methods of condition monitoring like partial discharge, tangent delta, frequency response analysis, dissolved-gas analysis, etc.
3. Focus on a particular method only
4. Focus on any modern methods such those that use optical approach
5. Focus on several case studies
6. Focus on standards used for each equipment
7. Focus on limitation of current approach
8. Combination of any two or more of the above.

1. Requires in-depth knowledge of condition monitoring and diagnostic testing techniques (WK4 - Engineering Specialist Knowledge, WK6 - Knowledge of engineering practice (technology) & WK8 - Research Literature)

WP1

2. No obvious solution

WP3

3. Infrequently encountered issues

WP4

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ASSESSMENT EXAMPLE – ASSIGNMENT

LO	PO	WP	BLOOM'S TAXONOMY
LO3 - Examine the high voltage testing and diagnostics on materials and electrical apparatus	PO2 – Problem Analysis Identify, formulate, conduct research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences (WK1 to WK4) WK4 - Engineering Specialist Knowledge	WP1 - Depth of Knowledge Required (WK4 - Engineering Specialist Knowledge) WP3 - Depth of analysis required WP4 - Familiarity of issues WP5 - Extent of applicable codes (also possible)	C5 - Evaluate

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TTAC – MAPPING OF TECHNOLOGY PROFILES TOWARDS COURSES

Table 15.0 Mapping Course -Technology Services - Example: Biotechnology (BT) – Bachelor Degree

Technology Profiles	Expected Technology Competency	Course Code	Courses	Topics	SLT
Development	Problem identification				
	Propose Solution				
	Experimental design				
	Risk analysis				
Manufacturing	Proof of concept/prototype				
Testing	Quality approach concept				
	Test selection and planning (procedure)				
	Testing procedure				
	Diagnosis procedure				
Commissioning	Commissioning Planning				
Maintenance	Handover planning / process				
	Verification & Calibration				
	Planning of Maintenance				
	Maintenance process (checklist)				
	Improvement planning for				

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Thank You



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