OBE IMPLEMENTATION OF DIPLOMA OF ELECTRICAL ENGINEERING PROGRAMME

ETAC STANDARD 2020

FACULTY OF ELECTRICAL TECHNOLOGY AND ENGINEERING (FTKE)
UNIVERSITI TEKNIKAL MALAYSIA MELAKA (UTeM)

1 PROGRAMME EDUCATIONAL OBJECTIVES

Programme Educational Objective (PEO) are specific goals describing the expected achievement of graduates in their career and professional life after 3 to 5 years of graduation. Three main concepts for PEO for Engineering's Diploma Programme consist of apply engineering knowledge and contribution to respected field, the achievement in technical career as well as lifelong learning.

The objectives of this programme are:

1. Graduates will be Assistant Engineers who are knowledgeable and technically competent in related electrical engineering/electrical engineering technology field as demonstrated through career progression.
2. Graduates will be Assistant Engineers who are able to communicate professionally with society at large and being ethical and responsible in performing leadership role in an organisation.
3. Graduates will be Assistant Engineers who have vision in developing their self and career through lifelong learning or involve in technopreneurs sector.

2 PROGRAMME OUTCOMES

Generally, Programme Outcomes (PO) as shown in Table 1 are statements that describe what students are expected to know and be able to perform or attain by the time of graduation. These relate to the skills, knowledge, and behaviour that students have acquired through the programme. For DEL programme, students are expected to attain the following twelve (12) attributes:

Table 1 – Programme Outcomes for DEL Programme

No.	PROGRAMME OUTCOMES (PO)
PO1	**Engineering Knowledge** Apply knowledge of applied mathematics, applied science, engineering fundamentals and an engineering specialisation as specified in DK1 to DK4 respectively to wide practical procedures and practices.
PO2	**Problem Analysis** Problem analysis: Identify and analyse well-defined engineering problems reaching substantiated conclusions using codified methods of analysis specific to their field of activity (DK1 to DK4)

No.	PROGRAMME OUTCOMES (PO)
PO3	**Design** 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 investigations of well-defined problems; locate and search relevant codes and catalogues, conduct standard tests and measurements
PO5	**Modern Tool Usage** Modern Tool Usage: Apply appropriate techniques, resources, and modern engineering and IT tools to well-defined engineering problems, with an awareness of the limitations (DK6)
PO6	**Engineer and Society** 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)
PO7	**Environment and Sustainability** Environment and Sustainability: 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** Understand and commit to professional ethics and responsibilities and norms of technician practice (DK7)
PO9	**Individual and Team Work** Individual and Team Work: Function effectively as an individual, and as a member in diverse technical teams
PO10	**Communication** 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 apply these to one's own work, as a member or leader in a technical team and to manage projects in multidisciplinary environments.
PO12	**Life-long Learning** Recognise the need for, and have the ability to engage in independent updating in the context of specialised technical knowledge

3 RELATIONSHIP BETWEEN PO AND PEO

The Programme Outcomes (PO) are generally by product of the Programme Educational Objectives (PEO) set for this program. These POs are consequently related and aligned with the vision and mission of university. The relation between the PO and PEO are mapped as shown in the Table 2.

Table 2: The Matrix of PO and PEO

No	Programme Outcomes (PO)	PEO 1	PEO2	PEO3
PO1	Engineering Knowledge Apply knowledge of applied mathematics, applied science, engineering fundamentals and an engineering specialisation as specified in DK1 to DK4 respectively to wide practical procedures and practices.	√		
PO2	Problem Analysis Problem analysis: Identify and analyse well-defined engineering problems reaching substantiated conclusions using codified methods of analysis specific to their field of activity (DK1 to DK4)	√		
PO3	Design 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 investigations of well-defined problems; locate and search relevant codes and catalogues, conduct standard tests and measurements	√		
PO5	Modern Tool Usage Modern Tool Usage: Apply appropriate techniques, resources, and modern engineering and IT tools to well-defined engineering problems, with an awareness of the limitations (DK6)	√		
PO6	Engineer and Society 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)		√	
PO7	Environment and Sustainability Environment and Sustainability: 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 Understand and commit to professional ethics and responsibilities and norms of technician practice		√	
PO9	Individual and Team Work Individual and Team Work: Function effectively as an individual, and as a member in diverse technical teams		√	
PO10	Communication 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 apply these to one's own work, as a member or leader in a technical team and to manage projects in multidisciplinary environments.			√

No	Programme Outcomes (PO)	PEO 1	PEO2	PEO3
PO12	Life-long Learning Recognise the need for, and have the ability to engage in independent updating in the context of specialised technical knowledge			√

4 RELATIONSHIP BETWEEN COURSES AND PO

The details of mapping between courses and the PO are as tabulated Table 3. From the table, the balanced curriculum is reflected through the distribution of technical and non-technical courses. The breadths and depths of the courses are reflected through or embedded in the LO considering the levels and domains of the learning taxonomy. This is control by program coordinator using the OBE procedure and system.

Table 3: Matrix of Courses vs Programme Outcomes (PO)

No.	Code	Course	Core/ Elective	Programme Outcomes											
				1	2	3	4	5	6	7	8	9	10	11	12
1	DLLW 1112	Foundation English	Univ.										✓		
2	DLHW 2772	Appreciation Of Ethics And Civilisations	Univ.						✓		✓				
3	DLHW 1742	Leadership	Univ.									✓			
4	DKKX 1XX1	Co-Curriculum I	Univ.						✓			✓			
5	DLLW 2122	English For Effective Communication	Univ.										✓		
6	DELA 1212	Algebra	Core	✓											
7	DELA 1113	Physics	Core	✓	✓			✓							
8	DELE 1113	Principle Of Electrical And Electronics	Core	✓	✓			✓							
9	DELC 1113	Instrumentation And Measurement	Core	✓	✓			✓				✓			
10	DELE 1123	Digital Electronics	Core	✓	✓	✓		✓						✓	✓
11	DELP 1111	Basic Electrical Skill	Core	✓				✓			✓	✓			✓
12	DLLW 3132	English For Marketability	Univ.										✓		
13	DKKX 2XX1	Co-Curriculum II	Univ.						✓			✓			
14	DELA 1222	Calculus	Core	✓											
15	DMKU 1163	Introduction To Mechanical System	Core	✓	✓			✓							
16	DELE 1213	Analogue Electronics	Core	✓	✓			✓				✓			
17	DELP 1213	Electric Circuit I	Core	✓	✓			✓							
18	DITG 1113	Computer Programming	Core	✓		✓		✓							
19	DELP 1211	Electrical Workshop	Core				✓	✓	✓			✓			
20	DTMW 1012	Fundamental Of Entrepreneurship Enculturation	Univ											✓	✓
21	DELC 1313	Microprocessor	Core	✓		✓						✓	✓	✓	✓
22	DELA 1312	Safety And Health For Engineers	Core						✓	✓	✓		✓		✓
23	DELA 2333	Differential Equation	Core	✓											
24	DELE 2113	Electrical Machines	Core	✓	✓			✓		✓					
25	DELE 2123	Power Electronics	Core		✓			✓							✓
26	DELP 2113	Electric Circuit II	Core	✓	✓			✓							✓
27	DELC 2113	Control System Engineering	Core	✓	✓			✓							✓
28	DELC 2123	Automation	Core	✓	✓	✓			✓						
29	DELA 2342	Engineering Mathematics	Core	✓											
30	DELP 2213	Power System	Core		✓	✓	✓	✓							✓

No.	Code	Course	Core/ Elective	Programme Outcomes											
				1	2	3	4	5	6	7	8	9	10	11	12
31	DELP 2214	Project Diploma	Core			✓	✓	✓		✓	✓		✓	✓	✓
32	DELC 2213	Industrial Robotics	Core		✓	✓		✓	✓	✓					✓
33	DELP 2233	Building Maintenance And Management	Core		✓	✓		✓	✓	✓					✓
34	DELP 2223	Renewable Energy And Application	Core		✓	✓		✓	✓	✓					✓
35	DELU 3118	Industrial Training	Core	✓							✓	✓	✓		✓

5 COURSES VS KNOWLEDGE PROFILES (DK)

Based on ETAC Standard 2020, faculty has planned for curriculum improvement by having a clear mapping between courses and required knowledge profiles (see Appendix 1) and Table 4 provides the related information.

Table 4: Matrix of Courses vs Knowledge Profiles

No.	Code	Course	Category	Knowledge Profile (DK)						
				1	2	3	4	5	6	7
1	DLLW 1112	Foundation English	Univ.							
2	DLHW 2772	Appreciation Of Ethics And Civilisations	Univ.							
3	DLHW 1742	Leadership	Univ.							
4	DKKX 1XX1	Co-Curriculum I	Univ.							
5	DLLW 2122	English For Effective Communication	Univ.							
6	DELA 1212	Algebra	Core		✓					
7	DELA 1113	Physics	Core	✓					✓	
8	DELE 1113	Principle Of Electrical And Electronics	Core			✓			✓	
9	DELC 1113	Instrumentation And Measurement	Core			✓			✓	
10	DELE 1123	Digital Electronics	Core			✓		✓	✓	
11	DELP 1111	Basic Electrical Skill	Core			✓			✓	✓
12	DLLW 3132	English For Marketability	Univ.							
13	DKKX 2XX1	Co-Curriculum II	Univ.							
14	DELA 1222	Calculus	Core		✓					
15	DMKU 1163	Introduction To Mechanical System	Core			✓			✓	
16	DELE 1213	Analogue Electronics	Core			✓			✓	
17	DELP 1213	Electric Circuit I	Core			✓			✓	
18	DITG 1113	Computer Programming	Core			✓		✓	✓	
19	DELP 1211	Electrical Workshop	Core						✓	✓
20	DTMW 1012	Fundamental Of Entrepreneurship Enculturation	Univ							
21	DELC 1313	Microprocessor	Core			✓		✓		
22	DELA 1312	Safety And Health For Engineers	Core							✓
23	DELA 2333	Differential Equation	Core		✓					
24	DELE 2113	Electrical Machines	Core			✓			✓	✓
25	DELE 2123	Power Electronics	Core			✓			✓	
26	DELP 2113	Electric Circuit II	Core			✓			✓	
27	DELC 2113	Control System Engineering	Core			✓			✓	
28	DELC 2123	Automation	Core				✓	✓		✓
29	DELA 2342	Engineering Mathematics	Core		✓					
30	DELP 2213	Power System	Core			✓		✓	✓	
31	DELP 2214	Project Diploma	Core					✓	✓	✓
32	DELC 2213	Industrial Robotics	Core				✓	✓	✓	✓

No.	Code	Course	Category	Knowledge Profile (DK)						
				1	2	3	4	5	6	7
33	DELP 2233	Building Maintenance And Management	Core				✓	✓	✓	✓
34	DELP 2223	Renewable Energy And Application	Core				✓	✓	✓	✓
35	DELU 3118	Industrial Training	Core				✓		✓	✓

6 COURSES VS WELL-DEFINED PROBLEM SOLVING (DP) AND WELL-DEFINED ENGINEERING ACTIVITIES (NA)

In general, all courses mapped to the PO that have well-defined engineering problems elements such as PO1 to PO7 which require a depth emphasis on the well-defined problem solving elements/attributes (see Appendix 2). The assessment method must be able to measure the attainment of the learning outcome based on the well-defined engineering problems. The assessment of LO must show some evidence of the chosen well-defined problem-solving attributes. The lecturer has some flexibility to select the suitable well-defined problem-solving attributes in order to measure the outcome based on their expertise and creativity. However, the Faculty has set some specific minimum requirement for special courses as tabulated in Table 5 and Table 6 for the selected courses versus compulsory Well-defined Problem Solving (DP) and Well-defined Engineering Activities (NA) criteria respectively. These courses are chosen based on their delivery approach used methods which involve Well-defined engineering activities (see Appendix 3) and engineering responsibilities.

Table 5 : Matrix of Courses vs Well-defined Problem Solving (DP)

No.	Code	Course	Core/ Elective	Problem Solving (DP)						
				1	2	3	4	5	6	7
1	DELE 1123	Digital Electronics	Core	✓	✓	✓				
2	DELP 1213	Electric Circuit I	Core	✓		✓	✓			
3	DELC 1313	Microprocessor	Core	✓	✓		✓			
4	DELA 1312	Safety And Health For Engineers	Core	✓			✓	✓	✓	
5	DELE 2123	Power Electronics	Core	✓		✓	✓			
6	DELC 2113	Control System Engineering	Core	✓	✓	✓				
7	DELC 2123	Automation	Core	✓	✓	✓		✓		
8	DELP 2213	Power System	Core	✓	✓		✓			
9	DELP 2214	Project Diploma	Core	✓		✓	✓			
10	DELC 2213	Industrial Robotics	Core	✓		✓	✓			
11	DELP 2233	Building Maintenance And Management	Core	✓		✓	✓			
12	DELP 2223	Renewable Energy And Application	Core	✓		✓	✓			

Table 6 : Matrix of Courses vs Well-defined Engineering Activities (NA)

No.	Code	Course	Core/ Elective	Engineering Activities (NA)				
				1	2	3	4	5
1	DELC1313	Microprocessor	Core					✓
2	DELA 1312	Safety And Health For Engineers	Core				✓	
3	DELP 2214	Project Diploma	Core	✓		✓	✓	
4	DELU 3118	Industrial Training	Core		✓			✓

7 COURSES VERSUS STUDENT LEARNING TIME (SLT)

Table 7 summarizes time allocation for each course in the DEL programme, where students learning time (SLT) is derived based on the delivery method of each course. The distribution of the engineering and non-engineering courses for this programme is based on areas recommended by ETAC. A total of 67 credit hours stipulated for engineering courses, 14 credits for University Compulsory courses and 9 credits for Mathematics Courses. Mostly, the courses have direct contact students–lecturer/instructors through lectures, tutorials, and laboratory/workshop sessions. For courses with 3 credit hours, a 120 hours SLT is allocated while for 2 and 1 credit hours their allocation is 80 and 40 hours respectively. Student will undergo industrial training program for 16 weeks with 8 credits for this course. Final Year Project (ProDip) contributes to 4 credits hours.

Table 7: Student Learning Time of Courses for DEL Programme

Code	Course	Face-to-Face Learning					Self-Learning Activities		Formal Assess-ment	Total
		Teacher Centered (TC)	Student Centered Learning (SCL)				Student Direct Learning / Revision / Exercise	Student Direct Learning / Revision / Exercise for Practical Labs	Continuous Learning + Final Examination	
		Lecture	Tutorial	Practical	PBL / Other SCL	Practical Non Engineering				
DLHW 1012	FOUNDATION ENGLISH	28	3				45		4	80.00
DLHW 1742	LEADERSHIP	28	3				45		4	80.00
DLHW 2772	APPRECIATION OF ETHICS AND CIVILISATIONS	28	3				45		4	80.00
DKKX 1XX1/2XX 1	CO-CURRICULUM I					40				40.00
DLHW 2422	ENGLISH FOR EFFECTIVE COMMUNICATION	28	3				45		4	80.00
DEKA 1113	PHYSICS	28	4	23			44.4	16.1	5	120.50

DEKA 1212	ALGEBRA	28	3				45		4	80.00
DEKE 1113	PRINCIPLE OF ELECTRICAL AND ELECTRONICS	28	4	23			44.4	16.1	5	120.50
DEKP 1111	BASIC ELECTRICAL SKILL			25				14.5	0.5	40.00
DEKC 1113	INSTRUMENTATION & MEASUREMENT	28	4	23			44.4	16.1	5	120.50
DEKE 1123	DIGITAL ELECTRONICS	28	4	17	6		44.4	16.1	5	120.50
DLHW 3432	ENGLISH FOR MARKETABILITY	28	3				45		4	80.00
DEKA 1222	CALCULUS	28	3				45		4	80.00
DITG 1113	COMPUTER PROGRAMMING	28	4	23			44.4	16.1	5	120.50
DMCG 1323	INTRODUCTION TO MECHANICAL SYSTEM	28	4	23			44.4	16.1	5	120.50
DEKP 1213	ELECTRICAL CIRCUIT I	28	4	23			44.4	16.1	5	120.50
DEKP 1211	ELECTRICAL WORKSHOP			25				14.5	0.5	40.00
DEKE 1213	ANALOGUE ELECTRONICS	28	4	23			44.4	16.1	5	120.50
DKKX 1XX1/ 2XX1	CO-CURRICULUM II					40				40.00
DTMW 1012	FUNDAMENTAL OF ENTREPRENEURIAL ACCULTURATION	28	3				45		4	80.00
DEKA 1312	SAFETY AND HEALTH FOR ENGINEERS	28	3		6		41.5		2.25	80.75
DEKC 1313	MICROPROCESSOR	28		24	9		44.4	16.1	5	120.50
DEKP 2113	ELECTRICAL CIRCUIT II	28	4	23			44.4	16.1	5	120.50
DEKE 2123	POWER ELECTRONICS	28	4	23			44.4	16.1	5	120.50
DEKA 2333	DIFFERENTIAL EQUATIONS	42	7				64.8		6.75	120.55
DEKE 2113	ELECTRICAL MACHINES	28	4	23			44.4	16.1	5	120.50
DEKC 2123	AUTOMATION	28	4	17	6		44.4	16.1	5	120.50
DEKC 2113	CONTROL SYSTEM ENGINEERING	28	4	23			44.4	16.1	5	120.50
DEKA 2342	ENGINEERING MATHEMATICS	28	3				45		4	80.00
DEKP 2213	POWER SYSTEM	28	4	23			44.4	16.1	5	120.50
DEKP 2214	DIPLOMA PROJECT							160		160.00
CHOOSE ONLY TWO (2) EELCTIVE COURSES*										
DEKC 2213	INDUSTRIAL ROBOTIC	28	4	23			44.4	16.1	5	120.50*
DEKP 2233	RENEWABLE ENERGY AND APPLICATIONS	28	4	23			44.4	16.1	5	120.50*
DEKP 2223	BUILDING MAINTENANCE AND MANAGEMENT	28	4	23			44.4	16.1	5	120.50*
DEKU 3118	INDUSTRIAL TRAINING							320		320.00

Appendix 1: Knowledge Profile (DK)

The curriculum shall encompass the knowledge profile as summarised in the table below:

A programme that builds this type of knowledge and develops the attributes listed below is typically achieved in 2 and half – 3 years of study.

No.	Knowledge Profile
DK1	**Natural sciences** : A descriptive, formula-based understanding of the natural sciences applicable in a sub-discipline
DK2	**Mathematics:** Procedural mathematics, numerical analysis, statistics applicable in a sub-Discipline
DK3	**Engineering Fundamentals:** A coherent procedural formulation of engineering fundamentals required in an accepted sub-discipline
DK4	**Specialist Knowledge:** Engineering specialist knowledge that provides the body of knowledge for an accepted sub-discipline
DK5	**Engineering Design:** Knowledge that supports engineering design based on the techniques and procedures of a practice area
DK6	**Practical Engineering Practice:** Codified practical engineering knowledge in recognised practice area.
DK7	**Issues and approaches in engineering technician practice**: Knowledge of issues and approaches in engineering technician practice: ethics, financial, cultural, environmental and sustainability impacts

Appendix 2: Well-Defined Problem Solving

The range of well-defined problem solving as required by the Programme Outcomes is defined as follows:

No.	Attribute	**Well-Defined problems** have characteristic DP1 and some or all of DP2 to DP7:
DP1	Depth of Knowledge Required	Cannot be resolved without extensive practical knowledge as reflected in DK5 and DK6 supported by theoretical knowledge defined in DK3 and DK4
DP2	Range of conflicting requirements	Involve several issues, but with few of these exerting conflicting constraints
DP3	Depth of analysis required	Can be solved in standardised ways
DP4	Familiarity of issues	Are frequently encountered and thus familiar to most practitioners in the practice area
DP5	Extent of applicable codes	Are encompassed by standards and/or documented codes of practice
DP6	Extent of stakeholder involvement and level of conflicting requirements	Involve a limited range of stakeholders with differing needs
DP7	Interdependence	Are discrete components of engineering systems

Appendix 3: Well-Defined Engineering Activities

The range of well-defined engineering activities is defined as follows:

No.	Attribute	**Well-defined activities** means (engineering) activities or projects that have some or all of the following characteristics:
NA1	Range of resources	Involve a limited range of resources (and for this purpose resources includes people, money, equipment, materials, information and technologies)
NA2	Level of interactions	Require resolution of interactions between limited technical and engineering issues with little or no impact of wider issues
NA3	Innovation	Involve the use of existing materials techniques, or processes in modified or new ways
NA4	Consequences to society and the environment	Have consequences that are locally important and not far-reaching
NA5	Familiarity	Require a knowledge of practical procedures and practices for widely-applied operations and processes

Appendix 4: Guideline PO vs Knowledge Profiles

PROGRAM OUTCOME		DK	DP	NA
PO1	Engineering Knowledge	DK1 – DK4	√	
PO2	Problem Analysis	DK1 – DK4	√	
PO3	Design/Development of Solutions	DK5	√	
PO4	Investigation		√	
PO5	Modern Tool Usage	DK6	√	
PO6	The Engineer and Society	DK7	√	
PO7	Environment and Sustainability	DK7	√	
PO8	Ethics	DK7		
PO9	Individual and Teamwork			
PO10	Communication			√
PO11	Project Management and Finance			
PO12	Lifelong Learning			