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OBE IMPLEMENTATION OF BACHELOR OF MECHATRONICS ENGINEERING WITH HONOURS (BELM) PROGRAMME

EAC STANDARD 2020

FACULTY OF ELECTRICAL TECHNOLOGY AND ENGINEERING (FTKE)

UNIVERSITI TEKNIKAL MALAYSIA MELAKA (

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 Bachelor 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 to produce graduates who:

i. Practise mechatronics engineering knowledge creatively and innovatively in broad applications.
ii. Attain a successful career, possess leadership qualities, able to work independently, act professionally and practice ethical conduct.
iii. Engage with life-long learning and adapt to constantly evolving technology and entrepreneurial skills in decision making.

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 BELM programme, students are expected to attain the following twelve (12) attributes based on the EAC Standard 2020:

Table 1 – Programme Outcomes for BELM Programme based on Standard 2020 and Standard 2024

Standard 2024	Standard 2020	**PROGRAMME OUTCOMES (PO 12)**
PO1	**PO1**	Engineering Knowledge - Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialisation as specified in WK1 to WK4 respectively to the solution of complex engineering problems
PO2	**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).
PO3	**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).

Standard 2024	Standard 2020	PROGRAMME OUTCOMES (PO 12)
PO4	**PO4**	Investigation - Conduct investigation of complex engineering problems using research-based knowledge (WK8) and research methods, including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
PO5	**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).
PO6	**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).
	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)
PO7	**PO8**	Ethics - Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice (WK7).
PO9	**PO9**	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.
PO8	**PO10**	Individual and Teamwork - Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.
PO11	**PO11**	Lifelong Learning - Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PO10	**PO12**	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.

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**	√		

No.	Programme Outcomes (PO)	PEO 1	PEO2	PEO3
	Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialisation as specified in WK1 to WK4 respectively to the solution of complex engineering problems			
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).	√		
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).	√		
PO4	**Investigation** Conduct investigation of complex engineering problems using research-based knowledge (WK8) and research methods, including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.	√		
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).	√		
PO6	**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).		√	
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)	√		
PO8	**Ethics** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice (WK7).		√	
PO9	**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.		√	
PO10	**Individual and Team Work** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.		√	
PO11	**Life-long Learning** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.			√
PO12	**Project Management and Finance** Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply			√

No.	Programme Outcomes (PO)	PEO 1	PEO2	PEO3
	these to one's own work, as a member and leader in a team, to manage projects in multidisciplinary environments.			

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	Category	Programme Outcomes (PO)											
				1	2	3	4	5	6	7	8	9	10	11	12
1	BLLW 1142	English For Academic Purpose	Core									√		√	
2	BKKX XXX1	Co-Curriculum I	Univ.						√						
3	BMFG 1313 /BMIG 1313	Engineering Mathematics I	Core	√											
4	BEKG 1123 /BELG 1123	Principles Of Electric and Electronics	Core	√											
5	BMFG 1213 /BMIG 1213	Engineering Materials	Core	√	√										
6	BMCG 1123 /BMKU 1123	Statics & Mechanics of Material	Core	√	√										
7	BEKB 1131 /BELU 1131	Engineering Practice I	Core	√				√					√		
8	BKKX XXX1	Co-Curriculum II	Univ.						√						
9	BMCG 1013 /BMKC 1013	Differential Equations	Core	√											
10	BENG 1413 /BERN1413	Digital Electronics	Core	√	√										
11	BMCG 1523 /BMKU1313	Engineering Graphics and CAD	Core	√				√				√			
12	BEKU 1123 /BELU 1123	Electric Circuit I	Core	√	√										
13	BMCG 1253 /BMKU 1253	Dynamics & Mechanism	Core	√	√										
14	BEKB 1231 /BELU 1231	Engineering Practice II	Core	√				√					√		
15	BEKG 2443 /BELG 2443	Engineering Mathematics II	Core	√											
16	BITG 1233	Computer Programming	Core	√				√							
17	BEKU 2333 / BELU 2333	Electric Circuit II	Core	√	√										
18	BEKG 1233 /BELG 1233	Principles Of Instrumentation and Measurement	Core	√											
19	BEKM 2342 /BELM 2342	Introduction To Mechatronic	Core	√	√										
20	BMCG 2372 /BMKU 2372	Fluid Mechanics	Core	√	√										

No.	Code	Course	Category	Programme Outcomes (PO)											
				1	2	3	4	5	6	7	8	9	10	11	12
21	BEKU 1231 /BELB 1231	Electrical & Electronics Engineering Laboratory	Core		√			√				√	√		
22	BLLW 2152	Academic Writing	Univ.									√		√	
23	BENG 2143 /BERN 2143	Engineering Statistics	Core	√	√										
24	BEKC 2433 /BELC 2433	Signal & Systems	Core	√	√										
25	BEKE 2422 / BELE 2422	Analogue Electronics Applications	Core	√	√										
26	BEKC 3533 /BELC 3533	Introduction To Control System	Core	√	√										
27	BEKC 3543 /BELC 3543	Microprocessor	Core		√	√	√	√				√	√		
28	BEKM 2321 /BELM 2321	Mechanical Engineering Laboratory	Core		√			√				√	√		
29	BLLW 3162	English For Professional Interaction	Univ.									√			
30	BMFG 4623 /BMIU 3213	Engineering Economy and Management	Core		√		√						√		√
31	BEKG 2433 /BELG 2433	Electrical Systems	Core	√	√										
32	BEKM 3453 /BELM 3453	Microcontroller Technology	Core	√	√	√		√				√			
33	BEKM 3543 /BELM 3543	Electromechanical Systems	Core	√	√	√									
34	BEKC 3643 /BELC 3643	Control System Engineering	Core	√	√	√									
35	BEKC 2421 /BELC 2421	Control Systems Laboratory	Core		√			√				√	√		
36	BLHW 1762	Philosophy And Current Issues	Univ.						√	√					
37	BEKM 3653 /BELM 3653	Integrated Design Project	Core			√		√	√	√			√		√
38	BEKC 4753 /BELC 4753	PLC & Automation	Core	√		√		√				√			
39	BMCG 3643 /BMKU 3643	Hydraulic & Pneumatic Systems	Core	√	√				√						
40	BMCG 3653 /BMKU3653	Thermodynamics & Heat Transfer	Core	√	√										
41	BEKM 3641 /BELM 3641	Mechatronic System Engineering Laboratory I	Core				√	√				√			
42	BEKU 3695 /BELU 3695	Industrial Training	Core	√							√	√	√	√	
43	BEKU 4861 /BELU 4861	Engineering Seminar	Core						√	√	√				
44	BLLW 1XX2	Elective I (University) - Third Language	Univ.									√			
45	BEKU 4792 /BELU 4792	Final Year Project I	Core		√		√					√		√	
46	BEKM 4763/ BELM 4763	Robotics	Core	√	√	√									
47	BEKM 4783 / BELM 4783	Machine Vision	Elec.		√	√		√							
	BEKC 4773 /BELC 4773	Intelligent Control System / AI			√	√		√							
48	BEKC 2453 /BELC 2453	Communication Systems	Core	√	√										
49	BEKM 4751 /BELM 4751	Mechatronic System Engineering Laboratory II	Core				√	√				√			
50	BTMW 4012	Entrepreneur Technology	Univ.									√		√	√
51	BLHW 2772	Appreciation Of Ethics and Civilisations	Univ.						√	√					
	BLHW 2752	Malaysian Culture							√	√					

No.	Code	Course	Category	Programme Outcomes (PO)											
				1	2	3	4	5	6	7	8	9	10	11	12
52	BENG 4322 /BERN 3322	Engineer And Society	Core						√	√	√				
53	BEKU 4894 /BELU 4894	Final Year Project II	Core		√	√	√		√		√	√		√	
54	BXXX XXX2	Elective II (University) - General	Univ.									√			
55	BEKC 4683 /BELC 4683	Digital Control Systems	Elec.		√	√		√							
	BEKC 4883 /BELC 4883	Advanced Manufacturing Systems			√	√								√	
	BEKM 4823 /BELM 4823	Data Communications and Computer Networking			√	√								√	

5 COURSES VS KNOWLEDGE PROFILES (WK)

Based on EAC 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 (WK)							
				1	2	3	4	5	6	7	8
1	BLLW 1142	English For Academic Purpose	Core								
2	BKKX XXX1	Co-Curriculum I	Univ.							√	
3	BMFG 1313 /BMIG 1313	Engineering Mathematics I	Core		√						
4	BEKG 1123 /BELG 1123	Principles Of Electric and Electronics	Core	√		√					
5	BMFG 1213 /BMIG 1213	Engineering Materials	Core	√		√					
6	BMCG 1123 /BMKU 1123	Statics & Mechanics of Material	Core			√					
7	BEKB 1131 /BELU 1131	Engineering Practice I	Core			√			√		
8	BKKX XXX1	Co-Curriculum II	Univ.							√	
9	BMCG 1013 /BMKC 1013	Differential Equations	Core		√						
10	BENG 1413 /BERG 1413	Digital Electronics	Core			√					
11	BMCG 1523 /BMKU1313	Engineering Graphics and CAD	Core			√			√		
12	BEKU 1123 /BELU 1123	Electric Circuit I	Core			√					
13	BMCG 1253 /BMKU 1253	Dynamics & Mechanism	Core			√					
14	BEKB 1231 /BELU 1231	Engineering Practice II	Core			√			√		
15	BEKG 2443 /BELG 2443	Engineering Mathematics II	Core		√						
16	BITG 1233	Computer Programming	Core		√				√		
17	BEKU 2333 / BELU 2333	Electric Circuit II	Core			√					
18	BEKG 1233 /BELG 1233	Principles Of Instrumentation and Measurement	Core			√					

No.	Code	Course	Category	Knowledge Profile (WK)							
				1	2	3	4	5	6	7	8
19	BEKM 2342 /BELM 2342	Introduction To Mechatronic	Core				√				
20	BMCG 2372 /BMKU 2372	Fluid Mechanics	Core		√						
21	BEKU 1231 /BELB 1231	Electrical & Electronics Engineering Laboratory	Core			√			√		
22	BLHW 2452 /BLLW 2152	Academic Writing	Univ.								
23	BENG 2143 /BERN 2143	Engineering Statistics	Core		√						
24	BEKC 2433 /BELC 2433	Signal & Systems	Core			√					
25	BEKE 2422 / BELE 2422	Analogue Electronics Applications	Core			√					
26	BEKC 3533 /BELC 3533	Introduction To Control System	Core		√	√					
27	BEKC 3543 /BELC 3543	Microprocessor	Core			√		√	√		√
28	BEKM 2321 /BELM 2321	Mechanical Engineering Laboratory	Core			√			√		
29	BLLW 3162	English For Professional Interaction	Univ.								
30	BMFG 4623 /BMIU 3213	Engineering Economy and Management	Core			√					√
31	BEKG 2433 /BELG 2433	Electrical Systems	Core			√					
32	BEKM 3453 /BELM 3453	Microcontroller Technology	Core				√	√	√		
33	BEKM 3543 /BELM 3543	Electromechanical Systems	Core			√		√			
34	BEKC 3643 /BELC 3643	Control System Engineering	Core				√	√			
35	BEKC 2421 /BELC 2421	Control System Laboratory	Core			√			√		
36	BLHW 1762	Philosophy And Current Issues	Univ.							√	
37	BEKM 3653 /BELM 3653	Integrated Design Project	Core					√	√	√	
38	BEKC 4753 /BELC 4753	PLC & Automation	Core				√	√	√		
39	BMCG 3643 / BMKU 3643	Hydraulic & Pneumatic Systems	Core				√				
40	BMCG 3653 /BMKU3653	Thermodynamics & Heat Transfer	Core			√					
41	BEKM 3641 /BELM 3641	Mechatronic System Engineering Laboratory I	Core						√		√
42	BEKU 3695 /BELU 3695	Industrial Training	Core				√			√	
43	BEKU 4861 /BELU 4861	Engineering Seminar	Core							√	
44	BLLW 1XX2	Elective I (University) - Third Language	Univ.								
45	BEKU 4792 /BELU 4792	Final Year Project I	Core			√	√				√
46	BEKM 4763/ BELM 4763	Robotics	Core				√	√			
47	BEKM 4783 / BELM 4783	Machine Vision	Elec.				√	√	√		
	BEKC 4773 /BELC 4773	Intelligent Control System / Ai					√	√	√		
48	BEKC 2453 /BELC 2453	Communication Systems	Core			√					

No.	Code	Course	Category	Knowledge Profile (WK)							
				1	2	3	4	5	6	7	8
49	BEKM 4751 /BELM 4751	Mechatronic System Engineering Laboratory II	Core						√		√
50	BTMW 4012	Entrepreneur Technology	Univ.								
51	BLHW 2772	Appreciation Of Ethics and Civilisations	Univ.							√	
	BLHW 2752	Malaysian Culture								√	
52	BENG 4322 /BERN 3322	Engineer And Society	Core							√	
53	BEKU 4894 /BELU 4894	Final Year Project II	Core			√	√	√		√	√
54	BXXX XXX2	Elective II (University) - General	Univ.								
55	BEKC 4683 /BELC 4683	Digital Control Systems	Elec.				√	√	√		
	BEKC 4883 /BELC 4883	Advanced Manufacturing Systems					√	√			
	BEKM 4823 /BELM 4823	Data Communications and Computer Networking					√	√			

6 COURSES VS COMPLEX PROBLEM SOLVING (WP) AND COMPLEX ENGINEERING ACTIVITIES (EA)

In general, all courses mapped to the PO that have complex engineering problems elements such as PO1 to PO7 which require a depth emphasis on the complex problem-solving elements/attributes (see Appendix 2). The assessment method must be able to measure the attainment of the learning outcome based on the complex engineering problems. The assessment of LO must show some evidence of the chosen complex problem-solving attributes. The lecturer has some flexibility to select the suitable complex problem-solving attributes 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 Complex Problem Solving (WP) and Complex Engineering Activities (EA) criteria respectively. These courses are chosen based on their delivery approach using methods which involve complex engineering activities (see Appendix 3) and engineering responsibilities.

Table 5 : Matrix of Courses vs Complex Problem Solving (WP)

No.	Code	Course	Category	Problem Solving (WP)						
				1	2	3	4	5	6	7
1	BEKC 3543/ BELC 3453	Microprocessor	Core	√		√	√			
2	BEKM 3453 / BELM 3453	Microcontroller Technology	Core	√		√				√
3	BEKM 3543 /BELM 3543	Electromechanical Systems	Core	√	√	√				√

No.	Code	Course	Category	Problem Solving (WP)						
				1	2	3	4	5	6	7
4	BEKM 3653 /BELM 3653	Integrated Design Project	Core	√	√	√	√	√	√	
5	BEKC 4753 /BELC 4753	PLC & Automation	Core	√		√	√			
6	BEKU 3695 /BELU 3695	Industrial Training	Core	√	√			√	√	
7	BEKU 4792 / BELU 4792	Final Year Project I	Core	√	√	√				
8	BEKM 4763 /BELM 4763	Robotics	Core	√	√		√			
9	BENG 4322 /BERN 3322	Engineer And Society	Core	√				√	√	
10	BEKU 4894 /BELU 4894	Final Year Project II	Core	√	√	√	√	√	√	√

Table 6 : Matrix of Courses vs Complex Engineering Activities (EA)

No.	Code	Course	Category	Engineering Activity (EA)				
				1	2	3	4	5
1	BEKC 3543/ BELC 3453	Microprocessor	Core	√		√		
2	BEKM 3453 /BELM 3453	Microcontroller Technology	Core	√		√		
3	BEKC 4753 /BELC 4753	PLC & Automation	Core	√	√	√		
4	BEKM 3653 /BELM 3653	Integrated Design Project	Core	√	√	√	√	√
5	BEKU 3695 /BELU 3695	Industrial Training	Core	√			√	
6	BEKU 4792 / BELU 4792	Final Year Project I	Core	√	√	√		
7	BENG 4322 /BERN 322	Engineer And Society	Core	√	√		√	
8	BEKU 4894 /BELU 4894	Final Year Project II	Core	√	√	√	√	√
9	BEKB 1131 /BELU 1131	Engineering Practice I	Core	√	√			
10	BEKB 1231 /BELU 1231	Engineering Practice II	Core	√	√	√		
11	BEKU 1231 /BELB 1231	Electrical & Electronics Engineering Laboratory	Core	√	√			
12	BEKM 2321 /BELM 2321	Mechanical Engineering Laboratory	Core	√	√			
13	BEKC 2421 /BELC 2421	Control Systems Laboratory	Core	√		√		
14	BEKM 3641 /BELM 3641	Mechatronic System Engineering Laboratory I	Core	√		√	√	
15	BEKM 4751 /BELM 4751	Mechatronic System Engineering Laboratory II	Core	√		√	√	

7 COURSES VERSUS STUDENT LEARNING TIME (SLT)

Table 7 and 8 summarise time allocation for each course in the BELM 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 EAC. A total of 102 credit hours stipulated for engineering courses and 33 credit hours for general education courses. Mostly, the courses have direct contact between 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 10 weeks with 5 credits for this course. Final Year Project I and II each contributes to 2 and 4 credits hours respectively and one 3 credit hours is allocated for Integrated Design Project.

Table 7: Student Learning Time of Engineering Courses for BELM Programme

Grouping	Course Code	Course Name	Course Type	Student Learning Time						Credits Hours	
				Guided Learning					Self-Learni	Others Eg:	Credits
				Lecture	Lab/ Workshop	Project	PBL /Design	Tutorial			
Circuit And Signal	BELU 1123	Electric Circuit I	Core	42				5.5	67.5	5	3
	BELU 2333	Electric Circuit II	Core	42				5.5	67.5	5	3
	BELC 2433	Signal and Systems	Core	42				5.5	67.5	5	3
Instrumentation And Control	BELG 1233	Principles Of Instrumentation and Measurement	Core	42				5.5	67.5	5	3
	BELC 3533	Introduction to Control System	Core	42				5.5	67.5	5	3
	BELC 2342	Introduction to Mechatronic Systems	Core	28				3.25	45.25	3.5	2
	BELC 3643	Control System Engineering	Core	42				5.5	67.5	5	3
Digital And Analog Electronics	BELG 1123	Principle Of Electrical and Electronics	Core	42				5.5	67.5	5	3
	BERN 1413	Digital Electronics	Core	36			6	5.5	67.5	5	3
	BELE 2422	Analogue Electronics Applications	Core	28				3.25	45.25	3.5	2
Machines and Drives	BELM 3543	Electromechanical Systems	Core	42				5.5	67.5	5	3
Electrical Energy Utilization	BELG 2443	Electrical Systems	Core	42				5.5	67.5	5	3

Grouping	Course Code	Course Name	Course Type	Student Learning Time						Credits Hours	
				Guided Learning					Self-Learni	Others Eg:	Credits
				Lecture	Lab/ Workshop	Project	PBL /Design	Tutorial			
Communication System	BEKC 2453	Communication System	Core	42				5.5	67.5	5	3
Computer Aided Engineering	BITG 1233	Computer Programming	Core	28	20			3.25	63.25	5.5	3
	BMKU 1253	Engineering Graphic And CAD	Core	28	20			3.25	63.25	5.5	3
Electronics and Microprocessor	BELC 3543	Microprocessor	Core	36			6	5.5	67.5	5	3
	BELM 3463	Microcontroller Technology	Core	36			6	5.5	67.5	5	3
Manufacturing/ Production	BELC 4753	PLC & Automation	Core	42				5.5	67.5	5	3
	BMKU 3643	ELydraulic and Pneumatic System	Core	42				5.5	67.5	5	3
Solid Mechanics	BMKU 1253	Dynamics & Mechanism	Core	42				5.5	67.5	5	3
Thermodynamics and Heat Transfer	BMKU 3653	Thermodynamics and Heat Transfer	Core	42				5.5	67.5	5	3
Fluid Mechanics	BMKU 2372	Fluid Mechanics	Core	28				3.25	45.25	3.5	2
Statics and Dynamic	BMKU 1123	Statics & Mechanic of Materials	Core	42				5.5	67.5	5	3
	BMKU 4763	Robotics	Core	42				5.5	67.5	5	3
Material Engineering	BMIG 1213	Engineering Materials	Core	42				5.5	67.5	5	3
Laboratory / Workshop	BELU 1131	Engineering Practice I	Core		20				18	2	1
	BELU 1231	Engineering Practice II	Core		20				18	2	1
	BELB 1231	Electrical & Electronics Laboratory	Core		20				18	2	1
	BELM 2321	Mechanical Engineering Laboratory	Core		20				18	2	1
	BELC 2421	Control Systems Laboratory	Core		20				18	2	1
	BELM 3641	Mechatronic System Engineering Laboratory I	Core		20				18	2	1
	BELM 4751	Mechatronic System Engineering Laboratory II	Core		20				18	2	1
Ethics And Responsibility	BELU 4861	Engineering Seminar	Core	14				6	18	2	1
	BERN 3322	Engineer And Society	Core	22			6	3	45.5	3.5	2

Grouping	Course Code	Course Name	Course Type	Student Learning Time						Credits Hours	
				Guided Learning					Self-Learni	Others Eg:	Credits
				Lecture	Lab/ Workshop	Project	PBL /Design	Tutorial			
Capstone Project	BEKM 3653	Integrated Design Project	Core	3			39		73	5	3
Electives	BELM 4783	Machine Vision	Elective	42				5.5	67.5	5	3*
	BELC 4773	Intelligent Control System / AI	Elective	42				5.5	67.5	5	3*
	BELC 4683	Digital Control Systems	Elective	42				5.5	67.5	5	3*
	BELM 4863	Industrial Robotics	Elective	42				5.5	67.5	5	3*
	BELM 4823	Data Communications and Computer Networking	Elective	42				5.5	67.5	5	3*
Total Credits										**91**	
Industrial Training	BELU 3695	Industrial Training	Core						200		5
Final Year Project	BELU 4792	Final Year Project I	Core	3			6.5		67	3.5	2
	BELU 4894	Final Year Project II	Core	4			7		141.75	7.25	4
Total Credits										**11**	
Total Credits for Engineering Courses										**102**	

*Choose Two (2) of the Elective Specialization Courses

Table 8: Student Learning Time of General Education Courses for BELM Programme

Grouping	Course Code	Course	Course Type	Student Learning Time							Credits
				Guided Learning					Self-learni	Others Eg:	
				Lec.	Lab/ Workshop	Proj.	PBL /Design	Tuto.			
Applied Science/ Maths/ Computer	BMIG 1313	Engineering Mathematics 1	Core	42				5.5	67.5	5	3
	BMKU 1013	Differential Equation	Core	42				5.5	67.5	5	3
	BELG 2443	Engineering Mathematics 2	Core	42				5.5	67.5	5	3
	BERN 2143	Engineering Statistic	Core	42				5.5	67.5	5	3
Total Credits											**12**
Management / Law/ Accountancy	BMIG 4623	Engineering Economy and Management	Core	42				5.5	67.5	5	3
	BTMW 4012	Entrepreneurship Technology	Core	22			6	3	45.5	3.5	2
Total Credits											**5**

Communication Skills/ Humanities/ Ethics	BLHW 1762	Philosophy and Current Issues	Univ.	22			6	3	45.5	3.5	2
	BLLW 1142	English For Academic Purpose	Univ.	22			6	3	45.5	3.5	2
	BLHW 2772 / BLHW 2752	Appreciation Of Ethics and Civilization/ *MALAYSIAN CULTURE	Univ.	22			6	3	45.5	3.5	2
	BLLW 1xx2	Elective I (University)	Univ.	22			6	3	45.5	3.5	2
	BLLW 2152	Academic Writing	Univ.	22			6	3	45.5	3.5	2
	BLLW 3162	English For Professional Interaction	Univ.	22			6	3	45.5	3.5	2
	BXXX XXX2	Elective II (University)	Univ.	22			6	3	45.5	3.5	2
Total Credits											**14**
Co-Curriculum	BKKK xxx1	Co-Curriculum I	Univ.				16		22	2	1
	BKKK xxx1	Co-Curriculum II	Univ.				16		22	2	1
Total Credits											**2**
Total Credits for Non-Engineering Courses											**33**

Appendix 1: Knowledge Profile (WK)

A programme that builds this type of knowledge and develops the attributes listed below is typically achieved in 4 to 5 years of study, depending on the level of students at entry.

No.	Knowledge Profile
WK1	A systematic, theory-based understanding of the **natural sciences** applicable to the discipline.
WK2	Conceptually based **mathematics**, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modelling applicable to the discipline.
WK3	A systematic, theory-based formulation of **engineering fundamentals** required in the engineering discipline.
WK4	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.
WK5	Knowledge that supports **engineering design** in a practice area.
WK6	Knowledge of **engineering practice** (technology) in the practice areas in the engineering discipline.
WK7	**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	Engagement with selected knowledge in the **research literature** of the discipline.

Appendix 2: Complex Problem Solving

The range of **complex problem solving** is defined as follows:

No.	Attribute	**Complex problems** have characteristic WP1 and some or all of WP2 to WP7:
WP1	Depth of Knowledge Required	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.
WP2	Range of conflicting requirements	Involve wide-ranging or conflicting technical, engineering and other issues.
WP3	Depth of analysis required	Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models.
WP4	Familiarity of issues	Involve infrequently encountered issues.
WP5	Extent of applicable codes	Are outside problems encompassed by standards and codes of practice for professional engineering.
WP6	Extent of stakeholder involvement and level of conflicting requirements	Involve diverse groups of stakeholders with widely varying needs.
WP7	Interdependence	Are high level problems including many component parts or sub- problems.

Appendix 3: Complex Engineering Activities

The range of **complex engineering activities** is defined as follows:

No.	Attribute	**Complex activities** mean (engineering) activities or projects that have some or all of the following characteristics:
EA1	Range of resources	Involve the use of diverse resources (and for this purpose resources include people, money, equipment, materials, information, and technologies).
EA2	Level of interactions	Require resolution of significant problems arising from interactions between wide ranging or conflicting technical, engineering, or other issues.
EA3	Innovation	Involve creative use of engineering principles and research-based knowledge in novel
EA4	Consequences to society and the environment	Have significant consequences in a range of contexts, characterised by difficulty of prediction and mitigation.
EA5	Familiarity	Can extend beyond previous experiences by applying principles- based approaches.