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## OBE POA Management Tools for Measuring Electrical Engineering Students' Individual PO Attainment

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### Abstract

The adoption of outcome-based education (OBE) is crucial for the higher learning education system since it mandates that the curriculum be created based on the targeted skills, knowledge, and attributes of the students by the time their graduate. Since the PEO, PO, and CO must be measured and analyzed as part of OBE measurement, a variety of tools from simple spreadsheets to sophisticated computing application tools have been developed to help educators easily manage and integrate OBE into the curriculum. This paper presents the development of outlines the OBE POA management tools that focused on students' which include PO achievement analysis. The OBE POA managing presented tools used input from course PO mapping, OBE ANAS results and course assessment list. The designed system is useful to represent the students' PO-Course-Assessment mapping for previous and upcoming courses offered by the student's curriculum program. This resulted to aid the academic advisor in managing and making plans to meet the desired indicator of all PO assigned by the institution. As a result, this tool greatly enhances advisors' ability to supervise their advisees' academic plans and establish strong relationships with them.

**Keyword:** OBE POA, PO Attainment, OBE ANAS, Students' Achievement, Academic Advisor

### Outcome-Based Education (OBE)

In an educational environment, the teaching and learning processes are essential for preparing students with valuable skills, knowledge, and attributes as has been introduced by William Spady in the Outcome-Based Education (OBE) concept in the 1970s (Spady & Marshall, 1991). A clear vision of what students should be able to do is required at the beginning of the OBE process, followed by the design of curriculum, instruction, and evaluation. As part of this method, everything in a system of education is organized and concentrated on the student's achievements based on the learning experiences at the end of his/her studies. Another way to look at it is that the OBE quantifies what students gain or learn rather than how and when it took place (Wang, 2021). Internationally, OBE is becoming

more and more important and widely recognized for promoting educational reform and policy. Consequently, OBE has been adopted by many nations, such as the United States, Canada, Australia, New Zealand, South Africa, Hong Kong, Malaysia, and others (Akir et al., 2012). The OBE movement is being pioneered in Malaysia by engineering faculty at numerous academic institutions including Universiti Kebangsaan Malaysia (UKM), Universiti Malaysia Pahang (UMP), and Universiti Putra Malaysia (UPM), Sunway University, Universiti Teknologi MARA (UiTM), and University Malaya (UM). The reason is that Engineering program accreditation is dependent on Continuous Quality Improvement (CQI) by an international agency, the Engineering Accreditation Council (EAC) which has been established by the Board of Engineers Malaysia (BEM). However, OBE adoption in Malaysia is still in its infancy, and its impact on student achievement is not fully understood.

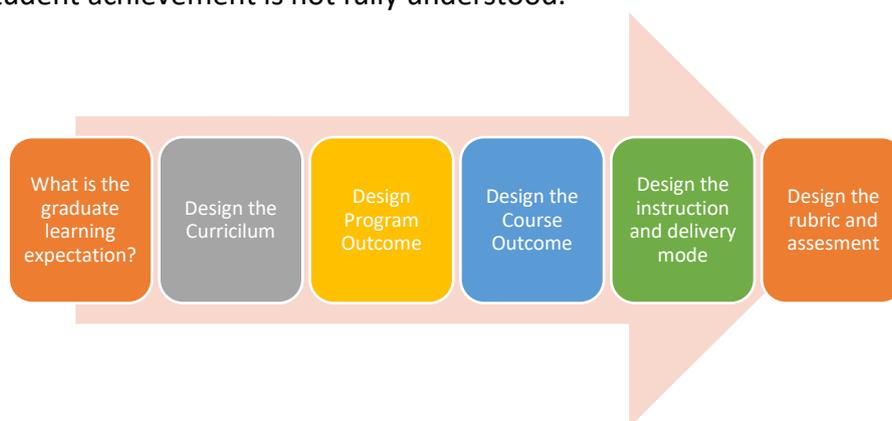


Figure 1. The sequence of the curriculum design process

Based on figure 1, the curriculum design program emphasizes and specifies the learning outcomes. Essentially, the process works in reverse order, beginning with the anticipation of what graduates will acquire after finishing their studies and ending with being ready for the workplace, then the curriculum design back to the program outcomes, and the course outcomes. Following that, teaching and delivery style will take place, and ultimately, the rubric and type of assessments will be designed (Eng et al., 2012). By OBE implementation, the assessment evaluation method was upgraded, with academics aiding students as needed. A well-designed continuous improvement process should contain a method that defines the activities, assessments of student learning outcomes, evaluations of achievement of intended objectives, and the implications of the activities for program adjustments. To create an effective continuous quality improvement process, the program faculty should provide evidence through quizzes, examinations, exams, laboratory work evaluation, case studies, mini-projects, and industry training (Idris et al., 2017). PO attainment is mostly determined by the student's performance and perceptions in several evaluation methods that represent the student's learning achievements. As a result, a good attainment method is required and vital to quantify student learning achievement and predict future performance (Rawat & Karkare, 2015).

### Literature Review

To measure the OBE, numerous tools can be utilized, ranging from a simple spreadsheet to an advanced programming system developed by the institutions. Works in (Malini et al., 2017), utilize tools known as INTI OBE Tool (IOBET), which is a spreadsheet-based to measuring student's learning PO attainment followed by the Engineering Accreditation

Council (EAC), for Faculty of Science, Technology, Engineering and Mathematics (FOSTEM) in INTI International University, Nilai, Malaysia. Works in Idris et al (2017) Idris et al (2018), construct the OBE-ANAS system as a tool for OBE measurement, and it was easy to deploy in assessing PO achievement for academic programs, Electrical and Chemical Engineering, Universiti Teknologi MARA (UiTM). Works in (Mohamad et al., 2021), using a quantitative survey to assess academic staff and student satisfaction levels in Civil Engineering, UiTM's known as MyCOPO system. The approach required academic staff to post their students' PO achievements in the system so that students could check their academic transcripts for all POs, every semester. To be advanced, works (Lumius & Asli, 2021), using machine learning algorithms, to generate predictive knowledge about the relationship between learning activities and performance in OBE that provide an interactive visualization result on student activities, student achievements, and OBEinsight, for their Accounting program, Universiti Malaysia Sabah. In today's rapidly evolving technology, (Ali et al., 2020) propose the theoretical design and progress of mobile OBE. The system known as i-MOBE was created essentially for academics and students to use in higher learning institutions.

This study proposes an OBE POA analyzing tool that the student's academic advisor can use to monitor and plan for the student's achievement regarding each PO specified by the program curriculum design. In this project, the system was specifically designed for the Engineering Program that follows the twelve POs provided by the Engineering Technology Accreditation Council (ETAC)(Hasliza et al., 2022).

## Methodology

The methodology parts are divided into two, first the overview of the OBE-ANAS tool that is already established by our 'program owner' (PU), which provides the output of PO attainment for every course registered under the curriculum program. Second, the proposed OBE POA system block diagram and process flow utilized the OBE-ANAS output as part of OBE POA input to analyze the individual student POs achievement by their respective academic advisor for a future action plan.

### *OBE ANAS Overview*

Since this effort enhanced the OBE-ANAS tools created by (Idris et al., 2017), a quick overview of OBE ANAS will be addressed. The OBE-ANAS tool has been developed by the Centre for Electrical Engineering Studies, Universiti Teknologi MARA Pulau Pinang (CEES UiTMPP) which acts as a 'programme owner' (PU) for Electrical Engineering (EE) diploma programme in all UiTM campuses including Pasir Gudang, Dungun, and Sarawak. The designed tool makes data analysis easier for preparing the accreditation Self-Assessment Report (SAR). This tool serves as a faculty indicator and suggests a better way for the faculty action committee to track and assess student performance outcomes. Typically, the Microsoft Visual C# and Microsoft SQL Server application are utilized to construct the OBE-ANAS system. The developer uses the graphical user interface (GUI), which is built on Microsoft Visual C#, to interact with the database. Now, the OBE ANAS has been updated to version 15.0 and the home page of the OBE-ANAS 15.0v system can be seen in Figure 2. Microsoft SQL Server 2017 Express Edition utilizes a freeware database as its storage system to minimize the cost of design.

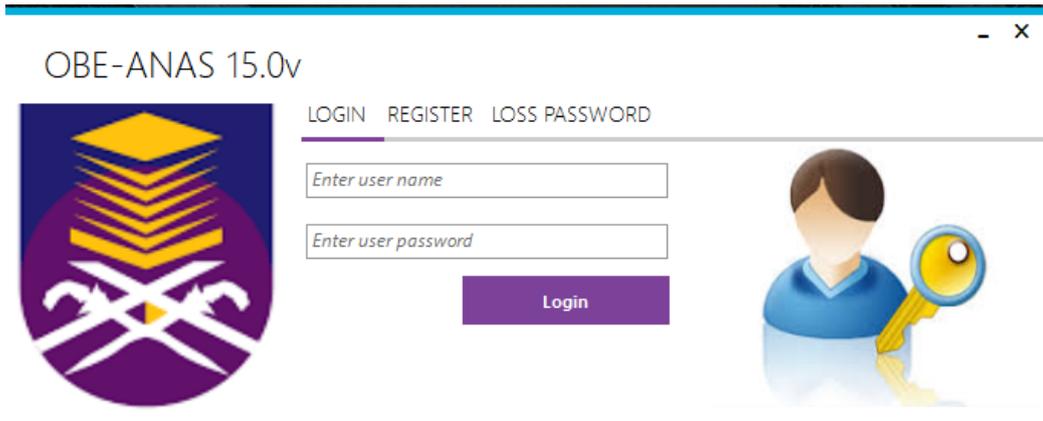


Figure 2: The example of GUI interface of OBE-ANAS 15.0v system

In the OBE ANAS template, the OBE marks are accessed through the course evaluation, which contains the detailed marks of COs and POs for each subject. As a result, the template called as 'COPO eRES template' was created specifically to easier the calculation of student's scores for the particular course. Figure 3 shows the example of the created 'COPO eRes template' for the Electric Circuit 2 course (one of the courses taken by part 3 student of Diploma in Electrical Engineering UiTM).

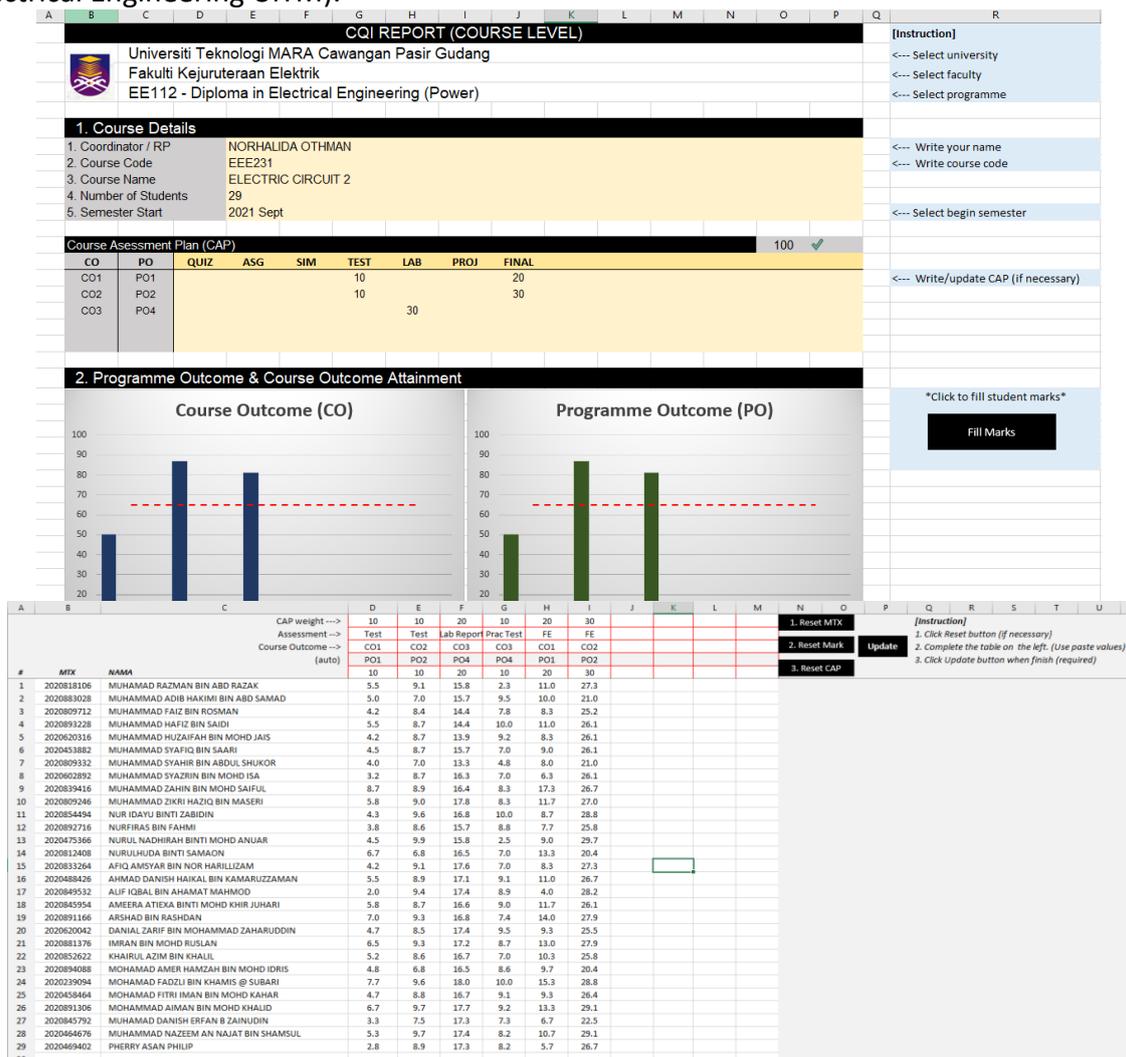


Figure 3: The example of COPO eRes Template

The lecturer in Charge (LIC) will combine all the data from all groups and enter the student grades using the template and the assessment categories found in the course data. This template typically includes all related assessments according to the course information including assignments, tests, lab work, small projects, final exams, and others. The instructor will have assigned grades to the students based on the assessment type, which are then translated into COs/POs grades. Then, the "OBE-ANAS" file will be created using the same template and will be uploaded to the OBE ANAS system. The OBE unit representative in the faculty will use the same tool to conduct the process of analyzing the POs attainment of the programme after all LICs are done input the student's data for each subject. The special login and password are used to access this section and enable the process.

Figure 4 shows the OBE-ANAS 15.0v tool for POs attainment analysis. By turning on the "Analysis Overall POs" button in the "ANALYSIS" tab area, the POs measurement result is achieved. The displayed scores are calculated using the average of each student's scores. The system determines this average mark by mapping all of the courses in the database to their respective POs. Then, these average scores generated from the dataset on the "Analysis" page is then transferred to the excel template before being uploaded into the POA system. As can be seen in Figure 4, the KPI level set by the faculty is 65%. The red highlighted column indicates that the students are not complying with the KPI while the green is vice versa. Due to the sample of students not having reached the upper part level, the yellow highlighted column reflects no courses linked to the designated POs.



Figure 4: An example of overall PO attainment result analysis from OBE ANAS 15.0v

### OBE POA System

In this project, the OBE POA system is a continuity process after the OBE ANAS analysis has been done. Once the PO Attainment results are obtained from the OBE ANAS, the OBE POA system will be a designed medium for an academic advisor (PA) and students to monitor the individual students' performances in the previous semester. Moreover, the OBE POA outcomes assist PA in advising the strategy for the future semester during the PA-student session.

Figure 5 displays the process block diagram of the developed OBE POA system. The system received three inputs: Course-PO mapping, the output generated from the OBE-ANAS system, and a list of course assessments. The system was integrated with the Student PA databases hence it provides two outputs: Student POA result and PO-Course Assessment mapping.

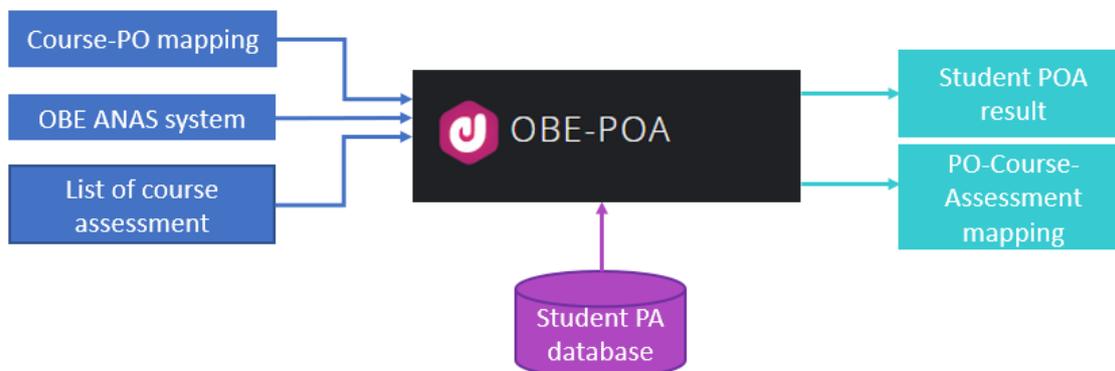


Figure 5: OBE POA system block diagram

Figure 6 represents the process or flow of the OBE POA system. Upon start-up of the login page, there are two available accounts: admin and user. The OBE team representative first receives an admin account authorization that allows them to upload the PO attainment results that have been acquired using OBE ANAS tools previously. After that, The PA that serves as an academic advisor reviews the PO attainment results for each student under their supervision using a user account. The PA must select the semester intake to view the PO attainment results displayed for each of his/her students. The results also show the mapping and achievement of the details of each twelve POs on each student. The list of courses and assessments that are mapped to each PO is also available in this system. To acquire a clear understanding and make a strategy for the next step to enhance their achievement outcomes, PA and students will participate in one-on-one coaching sessions.

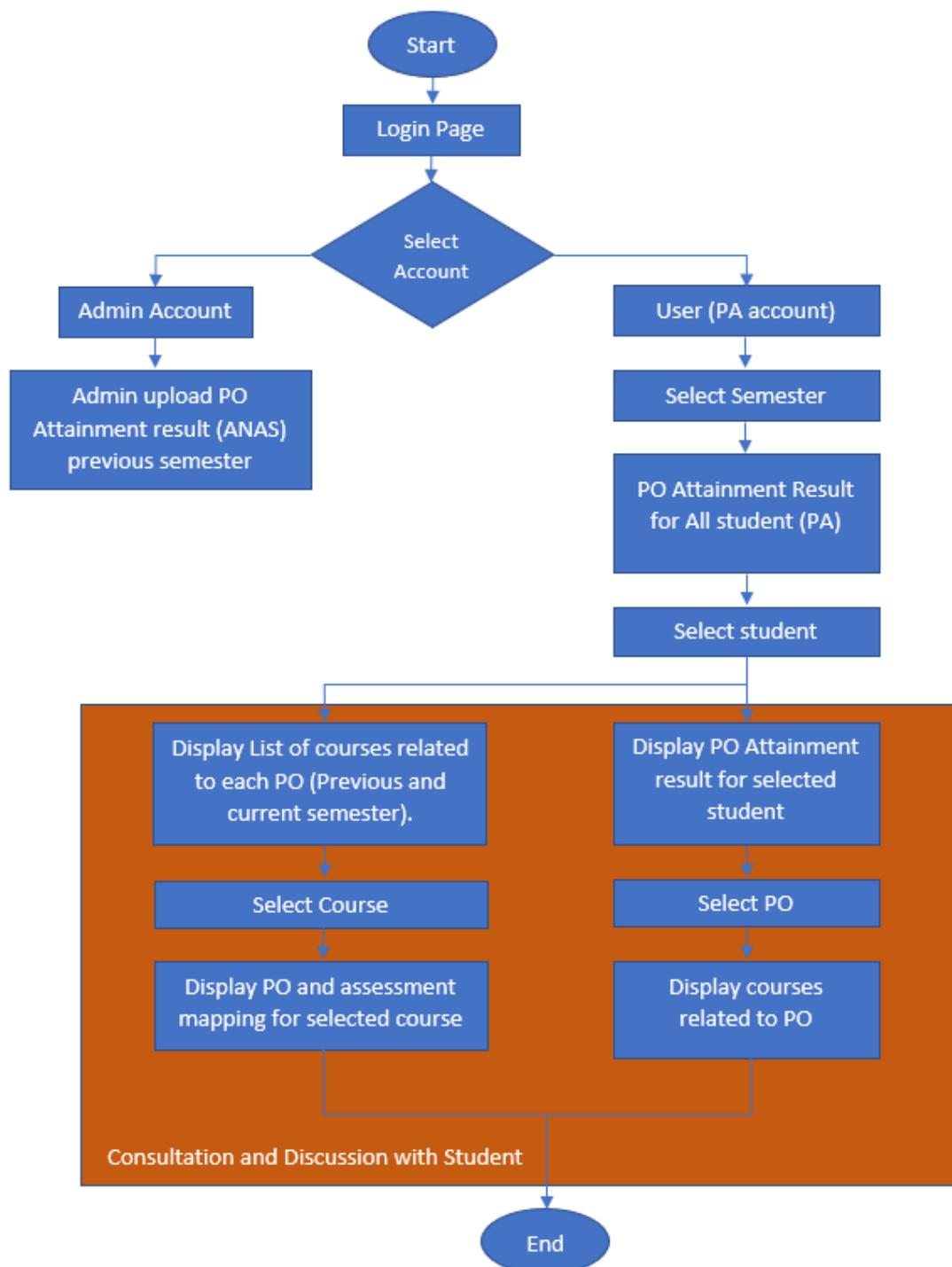


Figure 6: The flowchart of the OBE POA system

### Results and Discussion

OBE POA system is a management and measurement system especially established by the CEES UiTMPG in monitoring the students' PO attainment for each semester. Figure 7 shows the overview of the OBE POA system. The computer languages PHP, XAMP, and MySQL were used to create the dashboards. In addition, the system can be accessed by administrators and academic advisors in performance monitoring. PA will discuss one-to-one with their students on their PO attainments. Then, PA can advise and plan the next action that

the students must do. From Figure 9, the list of PA students will appear according to the PA account. Then, PA will click the student's name and the values of PO attainment for student X will be seen on the screen as in Figure 10. PA will click the red values, and the system will list all the subjects that are mapped to the POs. The list of courses that are not achieved 65% is illustrated in Figure 10 below. Then, the students will know the types of assessments that are mapped to the POs of the courses in Figure 11. Through PA-student sessions, a strong bonding connection between them can be fostered and make students feel comfortable to share everything with their PAs regarding their study especially.

OBE POA system will also benefit the PAs in providing a proper approach to explaining PO attainment results to the students. Due to the system being user-friendly and easy to assess, PAs just have to click, show and discuss the PO-Course-Assessment mapping only with their students. The administrative team and PAs can easily access this system where all input facts are successfully loaded and shown. Thus, this OBE POA system is simple to use. Furthermore, the coordination of the OBE POA system is clear and simple to understand. OBE POA system can provide an instant summary of the overall student accomplishment for audit and reporting purposes, especially in Continuous Quality Improvement (CQI). Overall, the process of data monitoring for students' SEE UiTMPG achievement has been improved by the introduction of the OBE POA system.

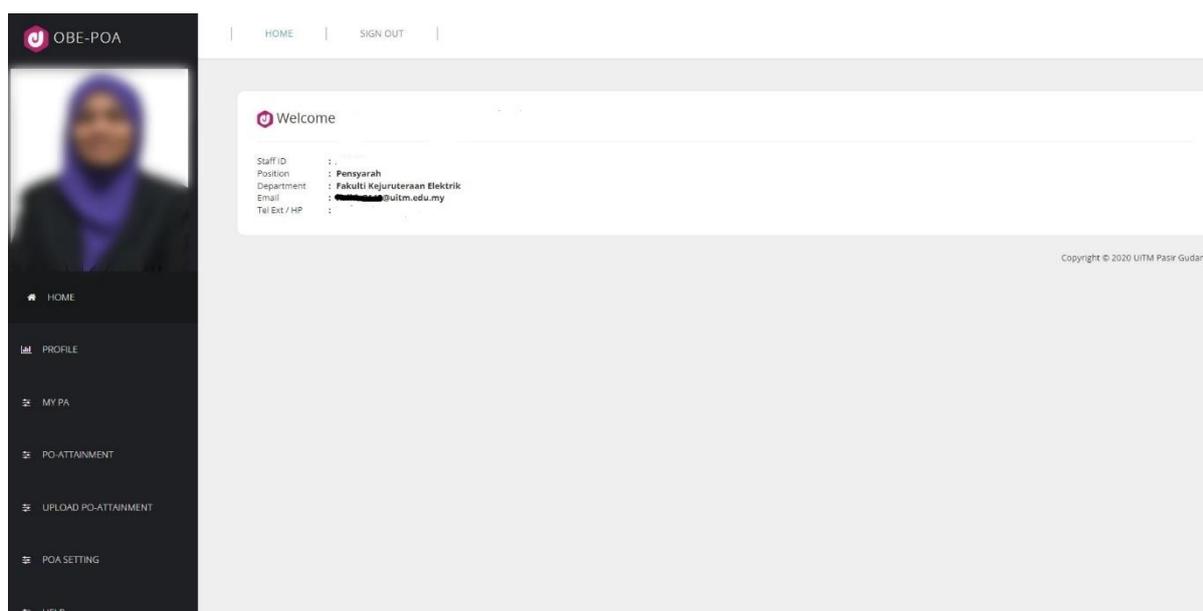


Figure 7: Overview of OBE POA system

LIST OF MY PA

**ADD NEW STUDENT**

BIL	STUDENT NAME	STUDENT ID	PA
1	MUHAMMAD AMIR SYAHIN BIN MOHD RAFE	2020842714	308142
2	MUHAMMAD AMIR SYAHMIR BIN ISHAK	2020478834	308142
3	MUHAMMAD AMIRUL HISHAM BIN ABD KARIM	2020818424	308142
4	MUHAMMAD AMIRUL NAJWAN BIN MOHD ABU ZARIM	2020839128	308142
5	MUHAMMAD AQL AZRAI BIN AZLAN	2020481548	308142
6	MUHAMMAD ARIF BIN JEFRI	2020858228	308142
7	MUHAMMAD DANISH MAZIRA BIN MOHD RAMSYINAR MAZIRA	2020468912	308142
8	MUHAMMAD FAKHRURAZI LUTFI BIN ABDUL MANAN	2020619996	308142
9	MUHAMMAD HAFIZ HAKIMI BIN ZAIDI	2020858774	308142

First | Previous | Next | Last

**BACK**

Figure 9: The list of PA account

The Values shown by POs are cumulative from semester 1 up to previous semester. Please pay attention to RED color POs

BIL	STUDENT NAME	STUDENT ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	MUHAMMAD AMIRUL NAJWAN BIN MOHD ABU ZARIM	2020839128	70.93	56.88	77.28	73	74.67	77.75	71	73.56	57.4	70.34	0	47.67

List of Courses CURRENT SEMESTER ( SEMESTER 4 )

BIL	SEMESTER	COURSE NAME	CODE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	4	FUNDAMENTALS OF ENTREPRENEURSHIP	ENT300										✓	✓	✓
2	4	Digital Systems 1	ECE351			✓	✓								✓
3	4	Electronics 2	ELE242		✓		✓								✓
4	4	Final Year Project 1	EEE358				✓	✓							✓
5	4	Linear System	ESE241		✓			✓							✓
6	4	Electronics Design	ELE355			✓		✓						✓	
7	4	Communication Systems	ECM242		✓			✓						✓	
8	4	Introduction to Networking	ECE242			✓		✓						✓	
9	4	Industrial Instrumentation	ESE246		✓			✓						✓	
10	4	Power System	EPO246		✓			✓						✓	
11	4	Electrical Machines	EPO243	✓				✓					✓		

Figure 10: PO-Course mapping

BIL	SEMESTER	COURSE NAME	CODE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	4	FUNDAMENTALS OF ENTREPRENEURSHIP	ENT300										✓	✓	✓
2	4	Digital Systems 1	ECE351			✓	✓								✓
3	4	Electronics 2	ELE242		✓		✓								✓
4	4	Final Year Project 1	EEE358				✓	✓							✓
5	4	Linear System	ESE241		✓			✓							✓
6	4	Electronics Design	ELE355			✓		✓						✓	
7	4	Communication Systems	ECM242		✓			✓						✓	
8	4	Introduction to Networking	ECE242			✓		✓						✓	
9	4	Industrial Instrumentation	ESE246		✓			✓						✓	
10	4	Power System	EPO246		✓			✓						✓	
11	4	Electrical Machines	EPO243	✓				✓					✓		

COURSE DETAIL

BIL	SEM	COURSE NAME	CODE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	4	ELECTRONICS 2	ELE242		TEST 1 & TEST 2		LAB WORK								ASSIGNMENT

Figure 11: PO-Course-Assessment mapping

Conclusion

The OBE POA created especially for the use of academic advisor usage in managing their advisee PO attainment. The proposed tools designed utilizing advance computing language PHP, XAMP, and MySQL. The suggested tools were a continuation and required input from earlier established tools, OBE ANAS to perform perfectly. This tools display details of PO attainment of every registered student, hence once the academic advisor login to the database, he/ she can view and analyzed the PO performance for each advisee. Through this effort, the consultation is made simple to manage and plan for future academic affairs, and it has a positive effect on the perceptions and engagements between the advisor and advisee. In future, students can access this OBE POA system and monitor their performance time to time.

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