FINAL PROJECT REPORT

on

"Outcome Based Education"

By

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UNDER THE GUIDANCE OF

Prof. Deepti Reddy

SUBMITTED IN PARTIAL FULFILLMENT FOR THE DEGREE OF

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Computer Engineering

DEPARTMENT OF COMPUTER ENGINEERING

SIES GRADUATE SCHOOL OF TECHNOLOGY

NERUL, NAVI MUMBAI – 400706

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CERTIFICATE

This is to certify that the project entitled "**Outcome Based Education**" is a bonafide work carried out by the following students of final year in **Computer Engineering.**

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This report is submitted in partial fulfillment of the requirement for the award of "**Bachelor of Engineering**" in SIES Graduate School of Technology, Nerul of University of Mumbai during the academic year 2019-20.

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PROJECT REPORT APPROVAL

This project report entitled "**Outcome Based Education**" is approved for the degree of **Bachelor of Engineering** in **Computer Engineering.**

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Place:

DECLARATION

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misinterpreted or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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It is a great pleasure to present this report on 'Outcome Based Education' as a part of curriculum under the subject entitled 'Final Year Project'.

It's a pleasure that we find ourselves penning down these lines to express our sincere thanks to the people who helped us along the way in completing our project. We find inadequate words to express our sincere gratitude towards them.

We are profoundly grateful to Prof. Deepti Reddy for her expert guidance and continuous encouragement throughout to see that this project rights its target since its commencement to its completion. We would like to express deepest appreciation towards Dr.Atul N Kemkar, Principal, SIES Graduate School of Technology, Prof. Aparna Bannore, Head of Department of Computer Engineering and Prof.Masooda Modak, Project Coordinator whose invaluable guidance supported us in completing this project. At last we must express our sincere heartfelt gratitude to all the staff members of the Computer Engineering Department who helped me directly or indirectly during this course of work.

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CONTENTS

ABSTRACT

India produces more than a million engineering graduates per year. Although this is a large number, their employability is the pertinent question. To address issues of employability, relevance and quality of engineering education, several engineering institutions in India have started adopting an Outcome Based Education (OBE) philosophy. OBE is a process which involves alignment between learning outcomes, curriculum, instruction and assessment. The end goal of the OBE process is to ensure quality of engineering education as per global standards. Engineering institutions that adopt an OBE framework can ensure that they are offering global quality standards of the engineering profession and thus get accredited. The National Board of Accreditation (NBA) and National Assessment and Accreditation Council (NAAC) ensure that this goal is achieved. NBA and NAAC are two major bodies responsible for the accreditation of higher education institutes in the country. When it comes to testing the academic caliber of the students of a particular institution, a Self-Assessment Report (SAR) needs to be generated by every institution based on which the accreditation bodies rate the academic excellence of the students. The process of generation of SAR requires multiple steps. This project focuses on automating the process of generation of a part of the SAR report which mainly focuses on academic excellence and quality at the institute level. This report focuses on the methodology and implementation which will be utilized to create a fully functional application which will focus on automating student performance criteria of the Self-assessment report.

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AICTE	**All India Council for Technical Education**
ATCO	**Attainment Level of Course Outcome**
CO	**Course Outcome**
NAAC	**National Assessment and Accreditation Council**
NBA	**National Board of Accreditation**
OBE	**Outcome Based Education**
OR	**Orals**
PEO	**Program Educational Objective**
PO	**Program Outcome**
PR	**Practicals**
SAR	**Self Assessment Report**
TEE	**Term End Exam**
TW	**Term Work**
UI	**User Interface**
UT	**Unit Test**
UX	**User Experience**

1. INTRODUCTION

Outcome Based Education is a process which involves alignment between learning outcomes, curriculum, instruction and assessment. The end goal of the OBE process is to ensure quality of engineering education as per global standards. Engineering institutions that adopt an OBE framework can ensure that they are offering global quality standards of the engineering profession and thus get accredited.

OBE considers three important factors namely, Program Educational Outcomes (PEO's), Program Outcomes (PO's) and Course Outcomes (CO's). The SAR contains ten criteria out of which mapping of the above mentioned outcomes and Student performance are the most cardinal criteria which highlight the knowledge excellency of students of a particular institution. Our website application aims to automate the mapping of PEO's, PO's and CO's and generate the overall Student performance analysis.

The teachers of the institution provide input of the CO's according to their respective courses to the application website. All this information pertaining to students will be stored in a database managed at the institute level. Our application website will generate student performance report as per the standards of the accreditation bodies which will clearly elucidate the overall academic performance of the students of the institution.

The main motivation to create this project is to automate the process of generating the CO-PO Mappings which is a part of the SAR report and which signifies the academic excellence and quality provided by any technical institution. Creating an in-house project like this one, can help alleviate expenses incurred and reliance on external softwares. An in-house project like the OBE Tool can provide many more benefits to its stakeholders i.e the teachers apart from just cutting down monetary expenses.

2. LITERATURE SURVEY

2.1 Curriculum Management System of IonCUDOS

IonCUDOS mainly focus on the curriculum design enabling faculties to create appropriate lesson plan, frame COs and mapping COs to POs and frame question banks. The curriculum delivery and assessment methods followed by the institutions will be intact and the software platform is compatible with all the delivery and assessment methods followed by the institutions and generates reports for students' attainment, Course Outcome (CO) attainment, Program Outcome (PO) attainment. IonCUDOS Outcome Based Education (OBE) platform helps institutionalizing OBE practices, achieving transparency, optimizing data inputs, standardizing computation of attainments, isolating areas for improvements, trends from large historical data from batches, and generating Self-Assessment Report (SAR) in a timely manner[3].

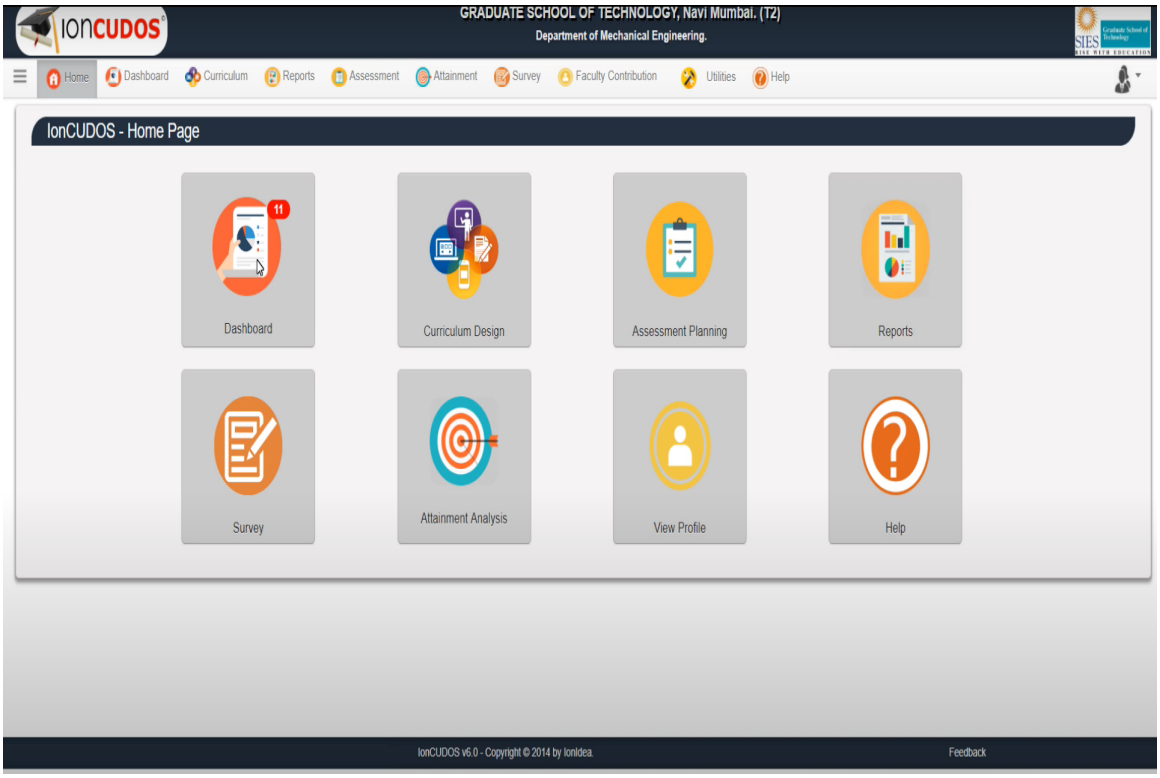

Fig 2.1.: IonCUDOS Dashboard

2.2 Limitations in the Existing System

The main problem with implementation of outcome based education is the broad definition of outcome based education itself. While it emphasizes the achievement of outcomes, this also refers to the achievement of course outcomes (CO) for a particular course. The normal operation for an academic programme is to further map the courses CO to the PO in order to observe the accumulative sum of CO contributing to the achievement of PO. The concept of OBE also does not provide for any specific procedure or follow a single idea in achieving the outcomes which led to confusion to how best implement an OBE curricula. The original concept of OBE should include the cyclic continual improvement with meaningful revision of teaching and learning, delivery and assessment methods. The confusion is also extended during the construction of learning outcomes for a particular course[1].

The IonCUDOS Software has the necessary functionalities required by the NBA. But there are 2 major drawbacks with this software which are complicated terminologies and rigidity. There are a lot of terminologies that are used which are difficult to understand for the faculty. If they had been explained or only if the required ones are kept in the software would have made the job easier for the faculty. There are cases where the database is to be updated by the faculty according to their requirements, since there are changes with every new academic year, and the support from IonCUDOS is very slow, and the faculty has to wait for a long period of time for the necessary changes to be done. This creates a lot of problems and delays the important work to be done by the faculty.

2.3 Objective

Accreditation is a mandatory process to be followed by the engineering colleges to ensure the quality of education system. The accreditation bodies like ABET or NBA assess the outcomes of an undergraduate engineering program. The outcomes are engineering competencies and skills that the student need to acquire to sustain in industry. The engineering colleges have to maintain enough evidence and documentation to show the achievement of outcomes. The major problem faced by faculty is measurement of a particular outcome. An online expert system is proposed to help engineering faculty in framing and implementing a teaching plan aligned with assessment of outcomes[2].

In order to gain a brief insight and challenges faced by our faculty with the existing system, a questionnaire was designed. The Questionnaire consisted of these questions like:

1)What do you teach?

2)What are your objectives as a teacher?

3)How would you characterize your interactions with students?

4)What do you expect of your students?

5)Do you face any difficulties while using the existing system?

This feedback from the faculty helped us to solve their problems and give them a better experience which is the ultimate goal of this project.

We have visited and tested the current system ourselves to identify and get familiar with the process. The current 3rd party software uses different access levels for stake holders having different positions in the Institution. For eg. the HOD has the entire control and can edit/view/create the pertaining COs and POs and assign it to the desired faculty. The faculty can then map these Course Outcomes calculated from various Learning Outcomes like tutorials, assignments, project evaluation, student portfolios, internal exam, vivas etc. to the Program Outcomes and grade them on the scale of 1(lowest) - 3(highest). The Final Attainment Level is calculated based on these CO-PO mappings and whether the student has achieved the target objectives is determined.

3. PROPOSED SYSTEM

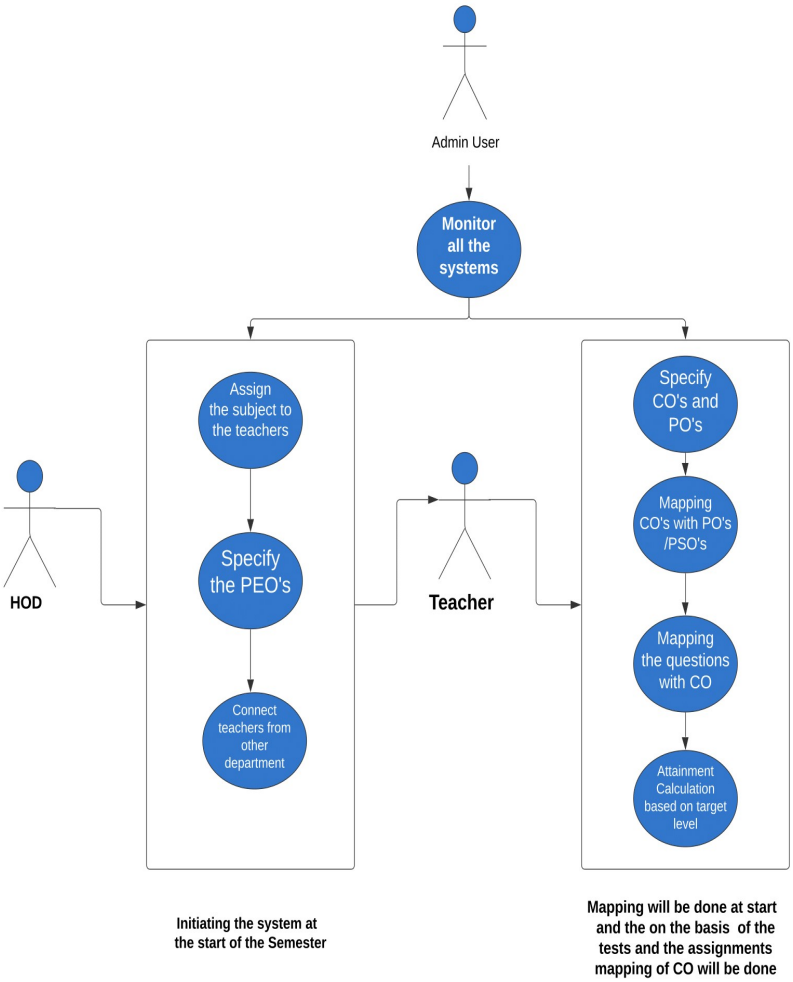

Fig 3.1.: Application Workflow

The above illustrated figure shows the basic functionality of our website application. The website application will be utilized by three different types of users. The admin is responsible for monitoring the overall working and functioning of the website application to ensure that the process right from teachers giving input to the calculation of student performance is carried out without any problems. The Admin user is given full control to the application website and its related databases. The next type of user of the system is the Head of the Department. The HOD is given the responsibility of assigning various courses to the teachers of their respective branch and also specifies the PEO's. The subjects assigned by the HOD to the department's teachers will appear on the teacher's account. This process will be carried out by the HOD at the beginning of every semester. The subjects which are assigned by the HOD to various teachers in the department appear in the profile and dashboard of each and every teacher's account.

The last type of user is the teacher. The teacher is responsible to specify the mapping of the PO's to their respective CO's. Various forms of assessments such as unit tests, assignments, projects are taken into consideration while mapping them with the course outcomes. The job of the system is to take this mapping provided by the teacher as input and calculate the attainment level achieved by the students with respect to each and every Course outcomes. Attainment levels would then be calculated for the PO's and PEO's as well. The calculation of attainment level gives the estimation of the portion of the students who were able to achieve the specified CO, then the PO and finally the PEO.

The proposed system can help to solve various drawbacks. First of all, IonCUDOS is a proprietary software which provides a multitude of generalised advanced applications and techniques for curriculum design and handling of various assessments. The OBE Tool which is proposed here specifically aims at providing the most basic application of curriculum design keeping in mind our own institution and design of engineering programs. Second of all, as IonCUDOS being a proprietary software, if any new features or functionalities are required, their implementation will take time and also be expensive. However, in the OBE Tool, if any changes are to be made to add new functionalities or remove them, they can be made without any delay as the OBE tool is an in-house application software and it belongs to our institution. For instance, if a user feels the need of addition of a new feature which might be very useful for processing data, while using IonCUDOS, the user will need to head over to the suggestions page and drop a suggestion to the development team. This change may or may not be implemented which depends upon how many users require this feature. But while using the OBE tool, the required functionalities can be easily implemented on teacher's demand. Moreover, this system is carefully designed after performing surveys which considered a teacher's requirements as the center of focus. As a result, the UI which has been developed is in accordance to the user's demands and requirements which will make the UX a smooth endeavor.

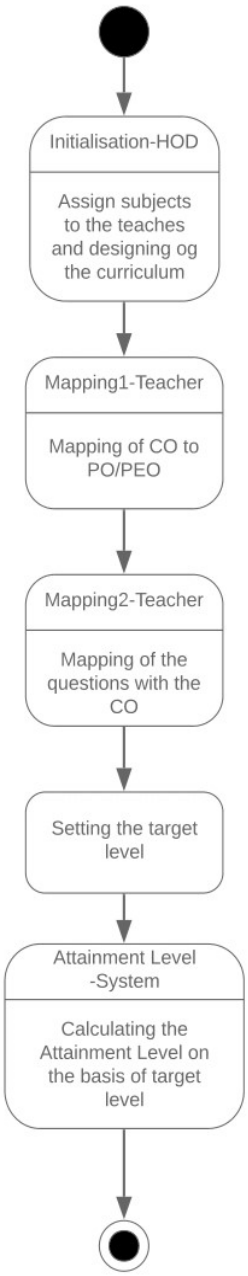

Fig 3.2.: Activity Diagram

The above illustrated figure gives the various activities which will take place throughout the process from input to output. Firstly, after the subjects are assigned by the HOD to various teachers in the department, the teachers will map the course outcomes of the courses assigned to them to the respective Program outcomes. The mapping is stored in a database hosted on local servers.

The second set of mapping is done again by the teachers. For instance, let us consider a unit test exam. The teacher specifies the mapping of questions which appeared in the exam with various course outcomes of that course. Same procedure is followed for assignments and projects. This mapping is again stored on the database. The last activity a teacher performs is to set the attainment level. The following snippet gives an illustration of various attainment levels and how they are achieved. This can change from program to program and is decided by the teacher.

Attainment Level 1: ***60%*** *students scoring more than University average percentage marks or set attainment level in the final examination.*

Attainment Level 2: ***70%*** *students scoring more than University average percentage marks or set attainment level in the final examination.*

Attainment Level 3: ***80%*** *students scoring more than University average percentage marks or set attainment level in the final examination.*

- *Attainment is measured in terms of actual percentage of students getting set percentage of marks.*
- *If targets are achieved then all the course outcomes are attained for that year. Program is expected to set higher targets for the following years as a part of continuous improvement.*
- *If targets are not achieved the program should put in place an action plan to attain the target in subsequent years.*

Fig 3.3.: A Snippet from the SAR format document published by NBA[4]

The details provided in the attainment levels by the teachers are also stored in their respective databases. After receiving all these inputs i.e the student marks data, CO-PO mapping, mapping of CO's with respect to specific assessment formats and lastly the attainment level details, the OBE Tool generates a report. This report can be viewed in graphical format as well as in tabular format as per the user's convenience.

4. DESIGN AND METHODOLOGY

4.1 User Interface Design

The OBE Tool's User Interface has been designed using HTML as the base markup language while CSS and BootStrap has been used to improve the aesthetics. JavaScript has also been used to perform certain functions. The figure depicted below is the Home Page of the OBE Tool. The Home Page depicts all the major modules of the website Application. The project as a whole has been divided into these four modules viz. Dashboard, Curriculum, Report and Profile. Each Module performs major functionalities for the OBE Tool. However, in order to access these functionalities the user needs to log in into his/her account or either sign up if the user is a first time user. The application does not allow usage of functionalities unless signed in and displays an alert to sign into an account first.

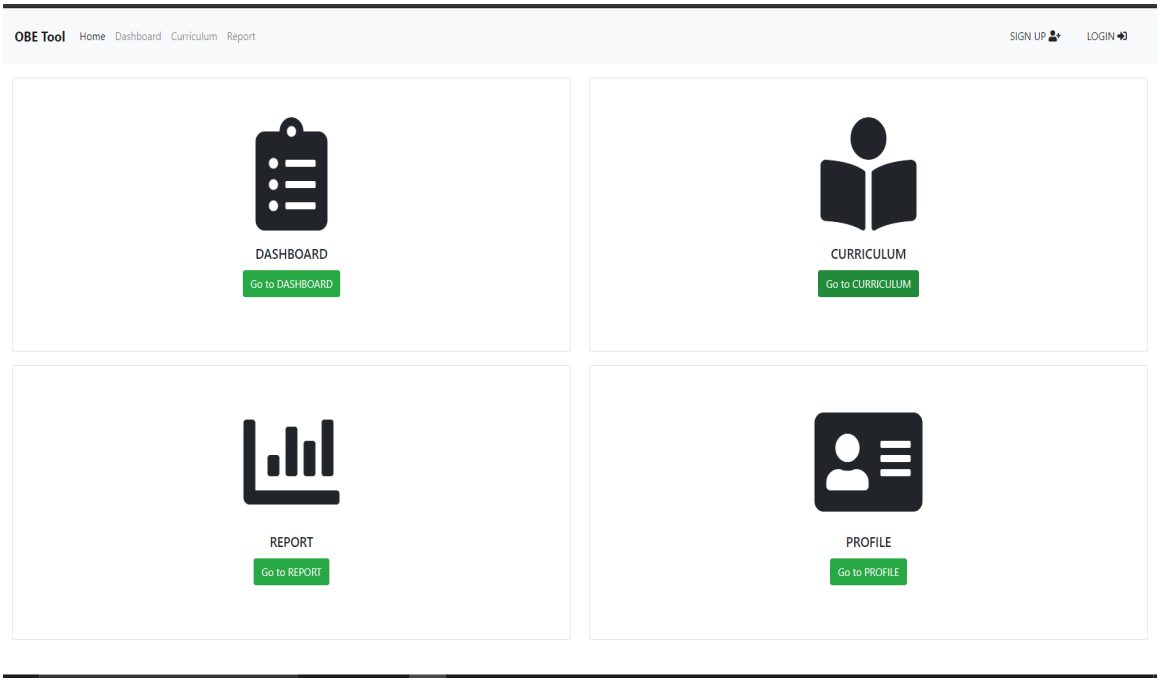

Fig 4.1.: Home Page

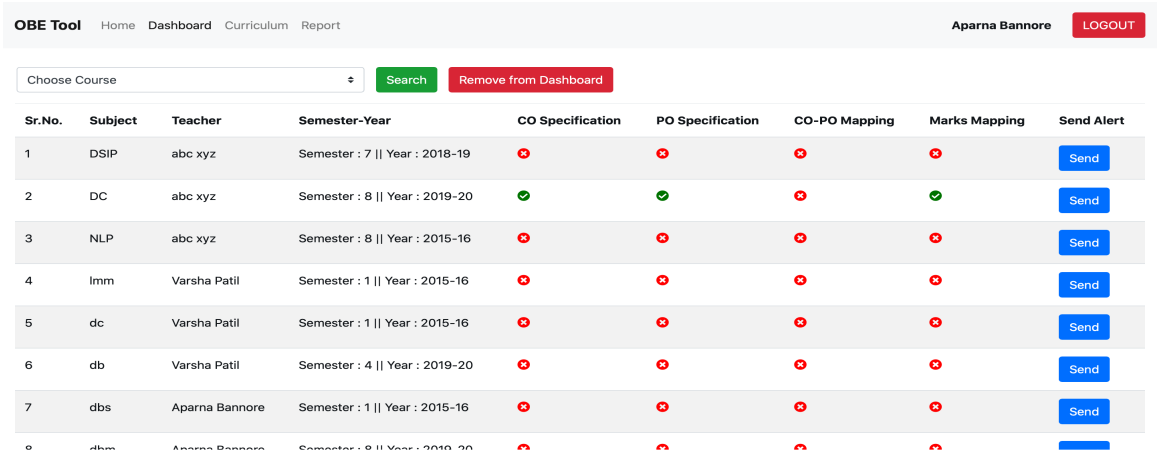

Fig 4.2.: Dashboard

The Dashboard represents all the subjects which have been assigned to a teacher. The dashboard for a HOD user has been shown above. It has a few extra functionalities as compared to a teacher's dashboard. The HOD's dashboard comprises of subjects which are assigned to all the teachers of that particular department. The HOD can track the progress of the records for any teacher and any subject assigned. The HOD can also send a reminder alert to a particular teacher to complete any remaining data entry or CO-PO mapping. The following figure depicts this process.

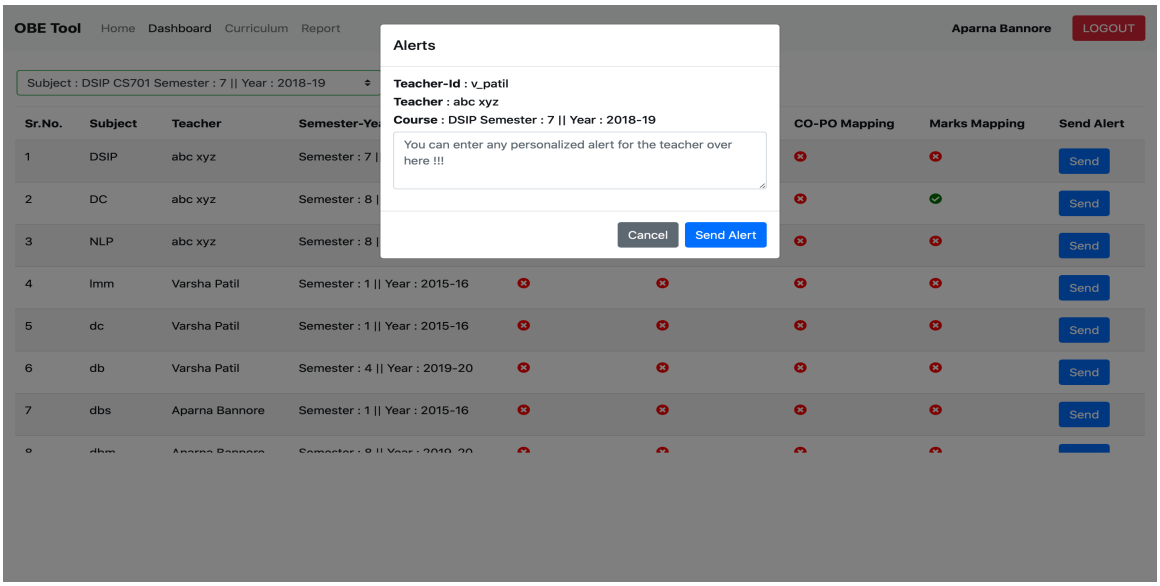

Fig 4.3.: Dashboard Alert

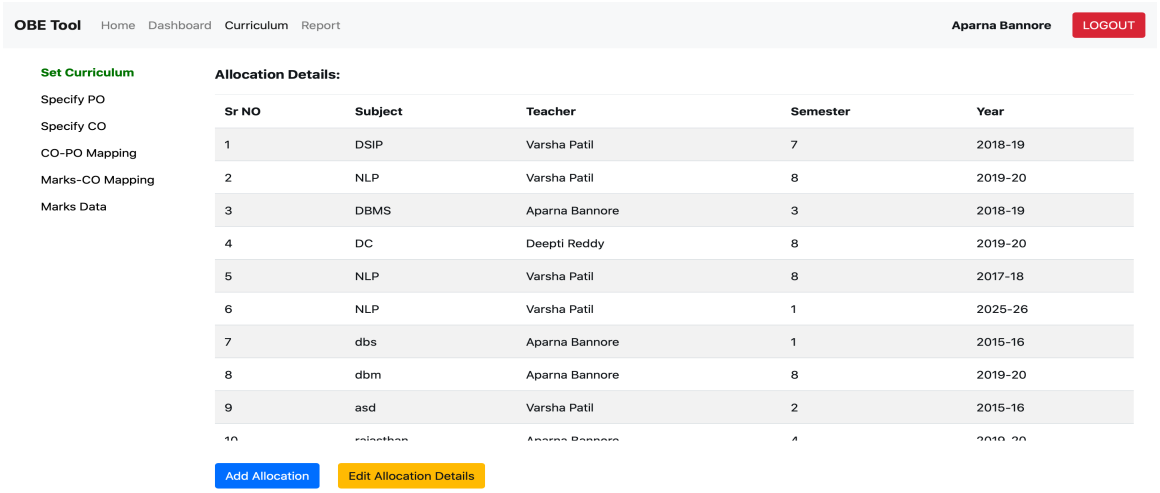

Fig 4.4.: Curriculum

The Curriculum module is shown above. It provides functionalities like 'Set Curriculum', Specify PO, 'Specify CO', 'CO-PO Mapping', 'Marks-CO Mapping' and 'Marks Data' where the function 'Set Curriculum' is exclusively available to the Head of the Department. The HOD is the only user who can assign subjects to the department's teachers via the 'Set Curriculum' function. The teachers Curriculum module looks exactly the same the the exception of 'Set Curriculum' function. The teacher can upload students marks using the 'Marks Data' function. The data must be uploaded in .csv format. The 'Show Data' button can be used to verify the uploaded data on the application itself. This is added for user's convenience. The following figure represents the Curriculum module's Marks Data functionality.

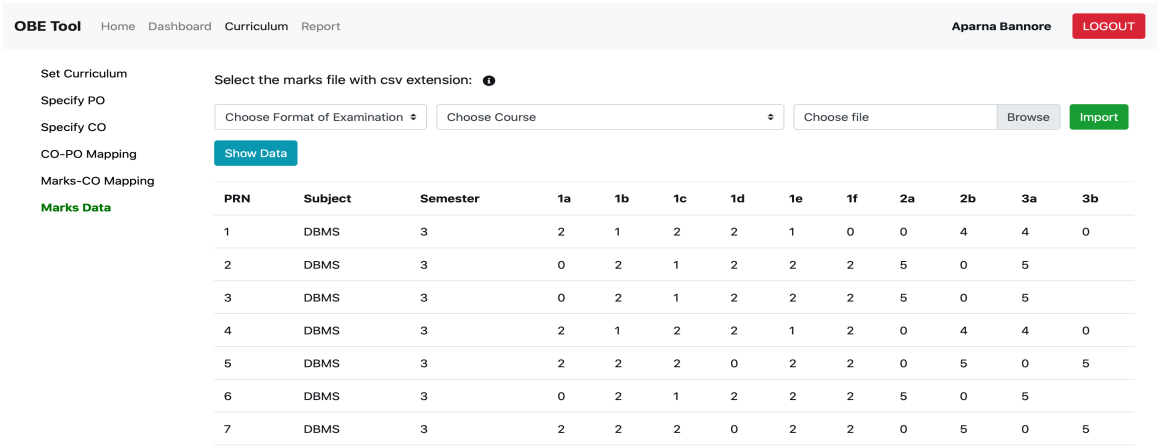

Fig 4.5.: Curriculum's Marks Data Functionality

The Report module is the module which does all the calculations and analysis. This module provides three main functionalities viz., 'Subject Analysis', 'CO Attainment Table' and 'PO Attainment Table'. Subject Analysis provides an overview of the processed data in form of Bar graphs and Pie charts. This function is mainly useful for teachers to get an overview of their students' success in a particular subject. Projecting Data in the form of graphs and charts makes it easy for the teachers to make future plans. It gives a clear idea of the of distribution of students according to attainment levels. The figure shown below shows the graphical representation i.e the 'Subject Analysis' functionality of the Report module.

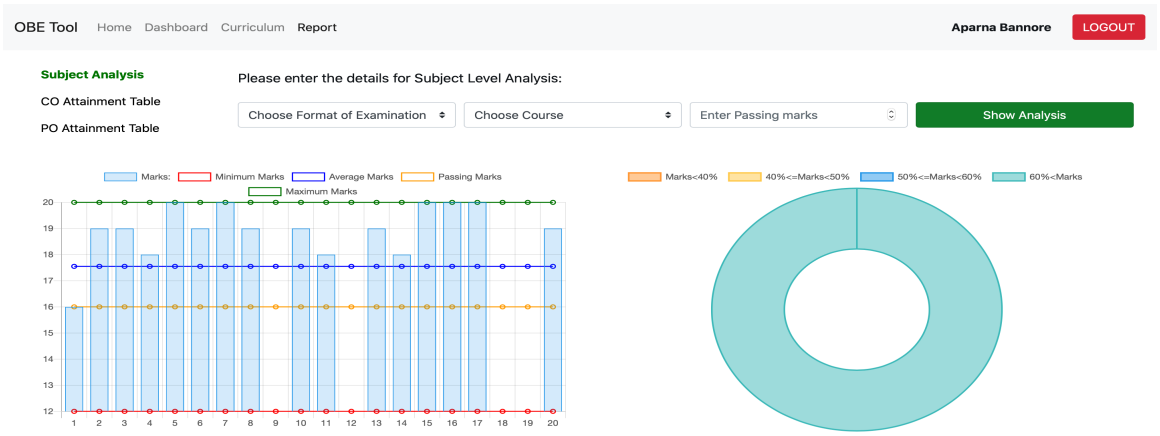

Fig 4.6.: Report

The Profile module provides a summary of the account. It lists all the subjects which are assigned to the teacher in the centre and lists important details like 'Id', 'Branch', 'Designation' on the left. The main motive of including the Profile module was to display the alerts given by the HOD. Whenever the HOD sends any customized alert to any specific teacher, that alert is displayed to the right of the Profile page. One more functionality which profile module offers is password change. The user can change the password anytime and the new password gets stored in the accounts database. The following figures depict the functionalities offered by the Profile module.

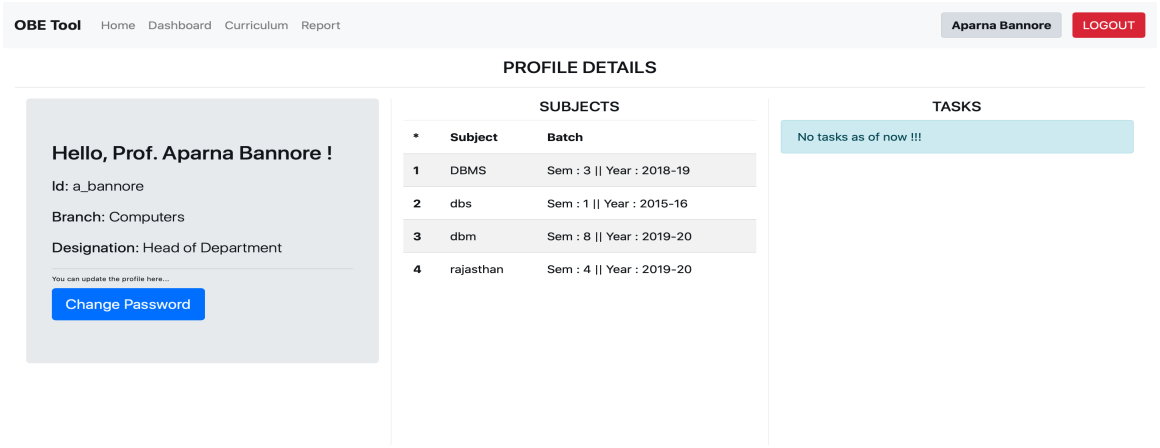

Fig 4.7.: Profile

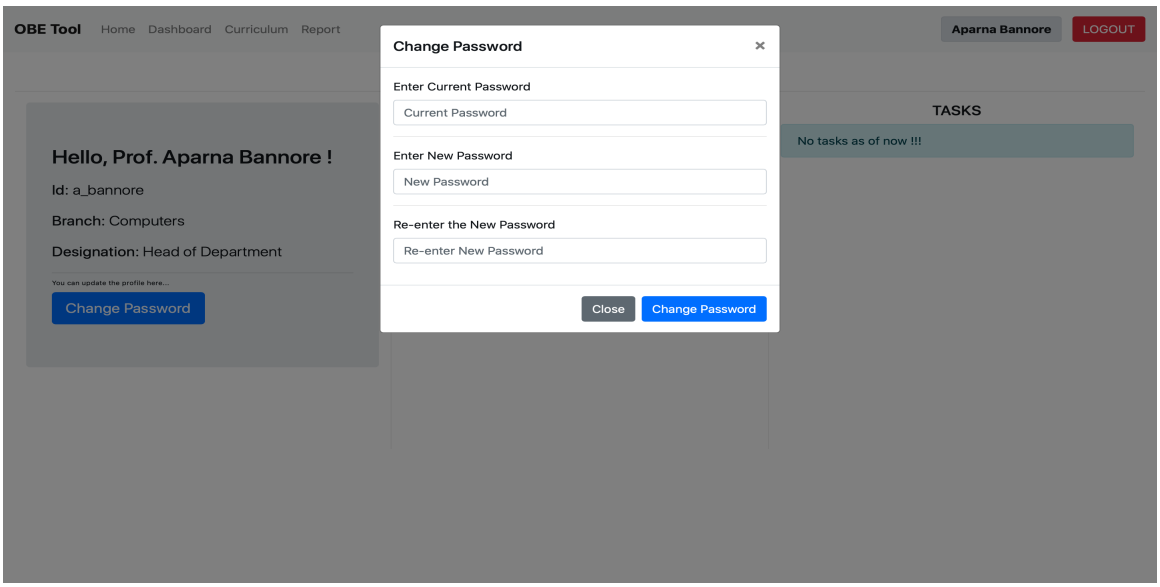

Fig 4.8.: Profile Password Change

4.2 Database Design

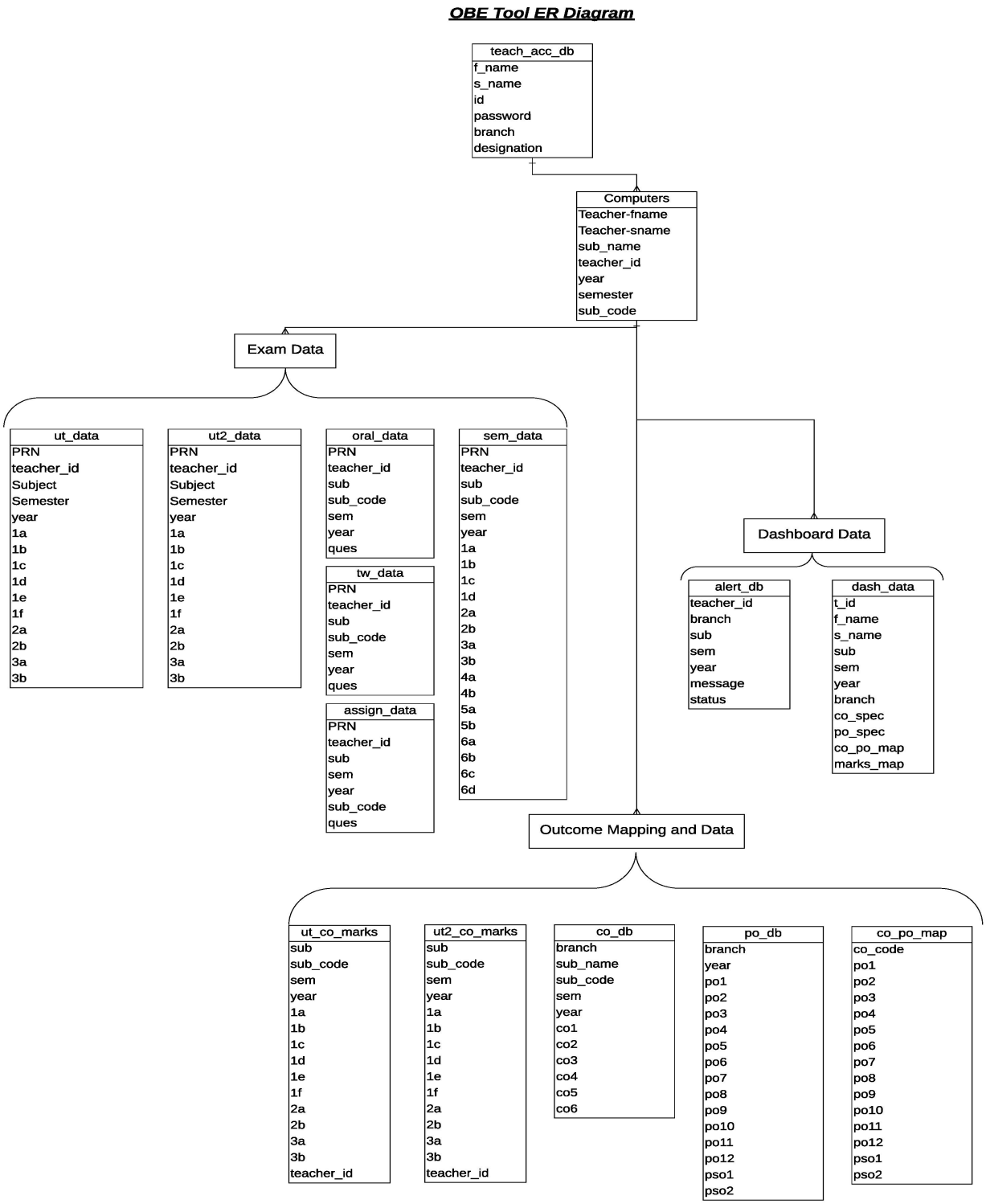

Fig 4.9.: Database Overview

The Database for the OBE Tool is designed using MySQL as a base and phpMyAdmin is utilized for management and administration of the entire database. The entire database for the OBE Tool has been divided into four sections viz. 'Accounts', 'Exam Data', Dashboard Data' and 'Outcome Mapping Data'. These four sections work in unison to form the collective database system behind the OBE tool.

Accounts

This section comprises of two databases which are the Teacher's Account Database and the branch specific teacher's database.. The 'teach-ac-db' is a generalization of 'Computers'. Multiple other branches like 'IT', 'Mechanical', 'Civil', etc can be derived from this generalized database.

Exam Data

This section of the database system comprises of those sets of databases which deal with storing the various assessment formats like semester examinations and internal examinations like vivas, term work and unit tests. Each assessment has it's own individual database to store the student's marks for that particular form of assessment.

Dashboard Data

This section comprises of databases exclusively created for storing data from the Dashboard module and managing the communication between the HOD and teachers via alerts. There is a separate database for storing the alerts created by the HOD so that they can be retrieved and displayed on the teacher's Profile module page.

Outcome Mapping and Data

This section of the database system contains a majority of tables as the calculation performed on the data are stored here. The various mappings like the CO to PO mapping, the CO to marks mapping are stored in their separate databases. Moreover, the PO's and the CO's which are given as input by the users are also stored in this section of the database. The Program and Course Outcomes have their own separate databases.

4.3 Methodology

In this section, the calculation of Course outcomes and the mapping of Course outcomes to Program Outcomes will be discussed. Unit tests (UT) and Term work (TW) fall under internal assessment and likewise Term End Exam (TEE) and Orals/Practicals (OR/PR) fall under the category of external assessments. For the purpose of explanation, let us consider a sample data of five students for a sample course 'XYZ' which has six course outcomes and eight Program Outcomes. The following table shows the Unit test 1 marks distribution for the five students.

PRN	1a	1b	1c	1d	1e	1f	2a	2b	3a	3b
1	2		2		1	0	5		5	
2	2	2	2	2	2			5		5
3	2	1	1	2		2	3		3	
4	0	1.5	2	1	2			4		3
5		2	0	2	2	2	5			5
CO	1	1	1	1	1	1	1	1	2	2

Table 4.1.: UT 1 Sample Data

PRN represents the Roll number of students and 1a, 1b, etc represents the questions of the unit test. The last row marked 'CO' tells us the default mapping of the Question to the CO. For instance, question 1a is mapped to CO1. This mapping is provided by the teacher via the curriculum module of the OBE tool along with the marks of each student. Similarly, the following table shows the Unit test 2 marks distribution for the same sample along with their CO mapping.

PRN	1a	1b	1c	1d	1e	1f	2a	2b	3a	3b
1		2	0	2	1.5	1		4	4	
2	0	1.5	1	2	2		5		5	
3	2	1	2	2		2	5			5
4	2	2	2		2	2		5		3
5	1	2		0.5	2	1.5		5	3.5	
CO	3	3	3	3	2	2	3	3	2	2

Table 4.2.: UT 2 Sample Data

For each unit test, questions 1a to 1f each have a maximum of 2 marks and questions 2a through 3b each have a maximum of 5 marks. The total marks for a unit test are 20. The following table represents the TEE , TW and OR/PR marks of the sample students where TEE maximum marks is 80 and TW and OR/PR both have 25 as maximum marks.

PRN	TEE	TW	PR/OR
1	58	23	19
2	64	21	22
3	54	23	22
4	60	22	18
5	68	20	20

Table 4.3.: TEE, TW and PR/OR Sample Data

The marks of TEE, TW and OR/PR are considered as mapped to all the Course outcomes. We will consider the following set of attainments for calculating the CO-PO mapping values.

Level	Level Description for above subject			
0	No student scoring		60	% and above in the question in Test/Tutorial/Assignment/Quiz
1	60	% students scoring		% and above in the question in Test/Tutorial/Assignment/Quiz
2	70	% students scoring		% and above in the question in Test/Tutorial/Assignment/Quiz
3	80	% students scoring		% and above in the question in Test/Tutorial/Assignment/Quiz

Table 4.4.: Attainments Considered

Now, we will perform attainment level calculations for Unit test 1 for the sample data.

	1a	1b	1c	1d	1e	1f	2a	2b	3a	3b
60% of total marks of question	1.2	1.2	1.2	1.2	1.2	1.2	3	3	3	3
No of students getting 60% or above	3	3	3	3	3	2	3	2	2	3
Attainment Level in %	75	75	60	75	75	66	100	100	100	100
Attainment Level	2	2	1	2	2	2	3	3	3	3
No. of Students Not attempted	1	1	0	1	1	2	2	3	3	2

Table 4.5.: Calculated UT 1 Attainments

For instance, consider question 1a. We know from earlier data, that question 1a is mapped to CO1. We calculate the attainment level in percent for question 1a by using the formula,

$$\frac{\text{(No. of students getting 60 \% or above) * 100}}{\text{(No. of students who attempted Q.1a)}}$$

So, for question 1a we get, 3*100/4 = 75 Now, for question 1a we have obtained attainment level in % as 75 which falls under attainment level 2 as per table 4.4. So, for question 1a, the attainment level of CO1 is 2. By using the similar process, we calculate attainment levels for each question from 1a to 3b. The above figure depicts that calculation. We perform a similar process on the Unit test 2 data as well. Following is the result obtained:

	1a	1b	1c	1d	1e	1f	2a	2b	3a	3b
60% of total marks of question	1.2	1.2	1.2	1.2	1.2	1.2	3	3	3	3
No of students getting 60% or above	2	4	2	3	4	3	2	3	3	2
Attainment Level in %	50	80	50	75	100	75	100	100	100	100
Attainment Level	0	3	0	2	3	2	3	3	3	3
No. of Students Not attempted	1	0	1	1	1	1	3	2	2	3

Table 4.6.: Calculated UT 2 Attainments

Since there are two unit tests, we obtain an average attainment for each CO from one to six by considering both the tests. The following figure shows the calculated values.

CO attainment of Unit test	
CO1	2.125
CO2	2.833
CO3	1.833
CO4	0
CO5	0
CO6	0

Table 4.7.: CO average for UT

Let us consider CO1, for instance. To calculate the cumulative attainment CO1 of both Unit tests, we first identify from the data which questions were mapped to CO1. From our sample data, we can say that CO1 was mapped to questions 1a through 2b in Unit test 1 only i.e in total CO1 was mapped to eight questions considering both unit tests. We then add up the individual calculated values of CO1 attainment from table 4.5 for the questions 1a through 2b of Unit test 1 and divide it with the total instances where CO1 was mapped i.e 8. In simple terms we are averaging the values of attainment. We perform a similar averaging process from the remaining CO's. The value of CO from CO3 to CO6 is 0 as CO3 to CO6 were not mapped to any question from any of the two unit tests. Until this point, we have completed the mapping of only one part of assessment i.e the Unit tests. We need to factor in other assessments like TEE, TW and OR/PR as well. For that purpose we use the data mentioned in table 4.3. We first calculate the CO for each category i.e TEE, TW and OR/PR. Following table shows the calculated CO.

	TEE	TW	OR/PR
60% of total marks	48	15	15
No of students getting 60% or above	5	5	5
Attainment Level in %	100	100	100
Attainment Level	3	3	3

Table 4.8.: Calculated TEE, TW and OR/PR attainments

The calculations for this process are the same which were performed as shown in table 4.5 so and table 4.6.

By default, we take a weighted average of internal and external assessments to get a single value for each CO from 1 to 6. The formula used to calculate weighted average for a CO is as follows.

CO(weighted average) =

$$0.3 * \frac{(\text{ATCO of UT} + \text{ATCO of TW})}{2} + 0.7 * \frac{(\text{ATCO of TEE} + \text{ATCO of OR/PR})}{2}$$

Where ATCO - Attainment Level of Course Outcome. 0.3 and 0.7 indicates that we have considered 30% from internal assessments and 70% from external assessments. We obtain the following weighted Average values for CO.

CO Attainment	Weighted average of both internals and Externals
CO1	2.868
CO2	2.975
CO3	2.825
CO4	2.55
CO5	2.55
CO6	2.55

Table 4.9.: Weighted Average

For instance, consider the calculation of CO1. We use the above formula and get,

CO1(Weighted Average) =

$$0.3 * \frac{(\text{ATCO1 of UT} + \text{ATCO1 of TW})}{2} + 0.7 * \frac{(\text{ATCO1 of TEE} + \text{ATCO1 of OR/PR})}{2}$$

$$\text{CO1(Weighted Average)} = 0.3 * \frac{((2.125 + 3)}{2} + 0.7 * \frac{(3 + 3)}{2}$$

CO1(Weighted Average) = 2.868

We calculate the weighted average of remaining CO's in a similar manner. We know that the teacher uploads their mapping of CO-PO as well. This mapping is an ideal mapping which is expected from accreditation councils. We generate our own CO-PO mapping which has been derived from the calculations using student's data. Now as an example, let us say that the following table is a CO-PO mapping uploaded by the teacher for this course.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3						
CO2	3							
CO3	3	3					2	
CO4	3	3	2				2	
CO5	3	3	2			3		
CO6	3		3			3		

Table 4.10.: Input Sample CO-PO mapping

This can be interpreted as CO1 is completely mapped to PO1 as their attainment level is 3. CO3 is 66% mapped to PO7 as their attainment level is 2. Now using the above mapping as a reference, the OBE tool will put in the calculated values of CO1 to CO6. The tool will form the following mapping and it will be provided as output. The following table represents the mapping which the tool will generate.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2.868	2.868						
CO2	2.975							
CO3	2.825	2.825					2.825	
CO4	2.55	2.55	2.55				2.55	
CO5	2.55	2.55	2.55			2.55		
CO6	2.55		2.55			2.55		

Table 4.11.: Calculated CO-PO mapping

5. RESULTS AND DISCUSSIONS

This chapter is going to be a walk-through of the OBE tool from the point of view of the HOD. It will contain the actions and steps the HOD user takes right from creating a curriculum to generating a report for the uploaded data. The following snapshot depicts the OBE tool logged into the HOD's account. The user's name appears on the top right corner of the Homepage which tells us about the current user who has logged into the tool.

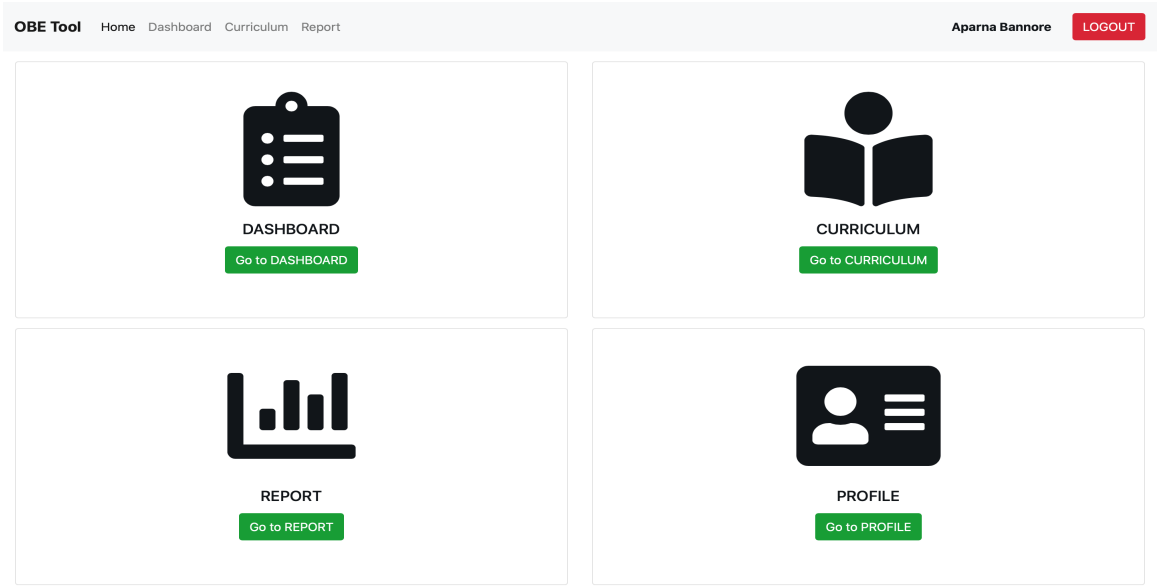

Fig 5.1 : HOD Login

The next step after successful account creation and sign in is setting the curriculum. The HOD heads on to the Curriculum module to set the curriculum. Clicking on Add Allocation button can help the HOD to assign a subject to a particular teacher. After an allocation has been made, it can still be updated by using the Edit Allocation option. The added allocations appear in a table in Set curriculum itself as seen in Fig 4.4.: Curriculum. The following snapshots i.e. Fig 5.2 and Fig 5.3 depict the Add and Edit Allocation processes.

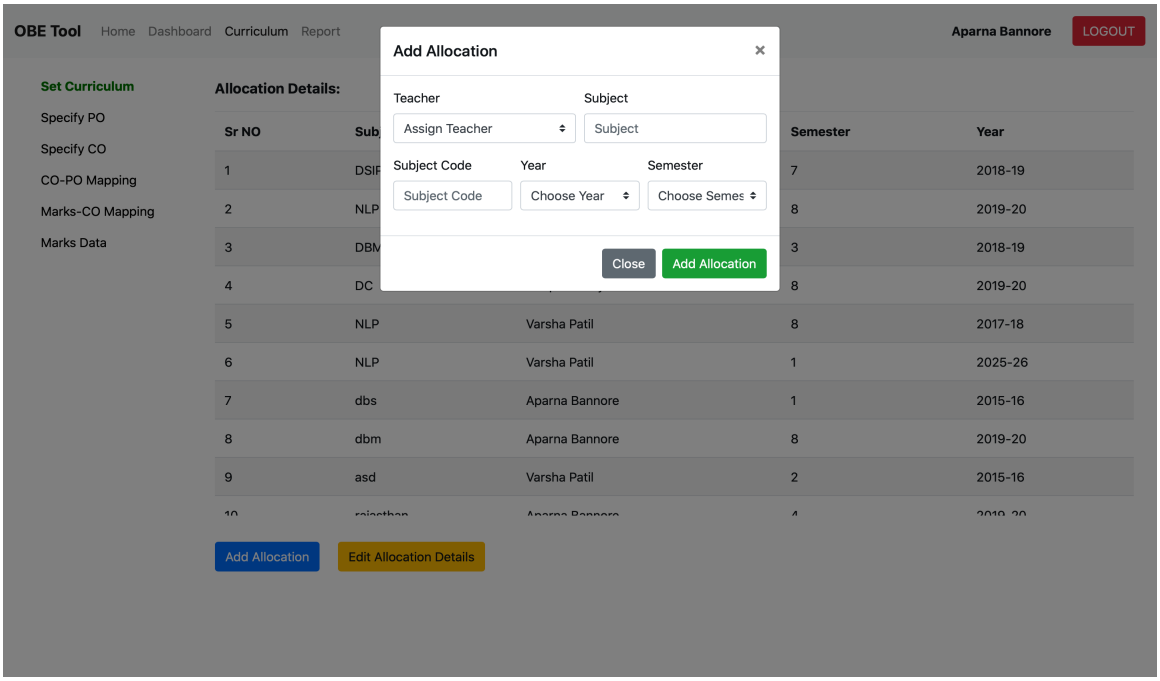

Fig 5.2 : Add Allocation

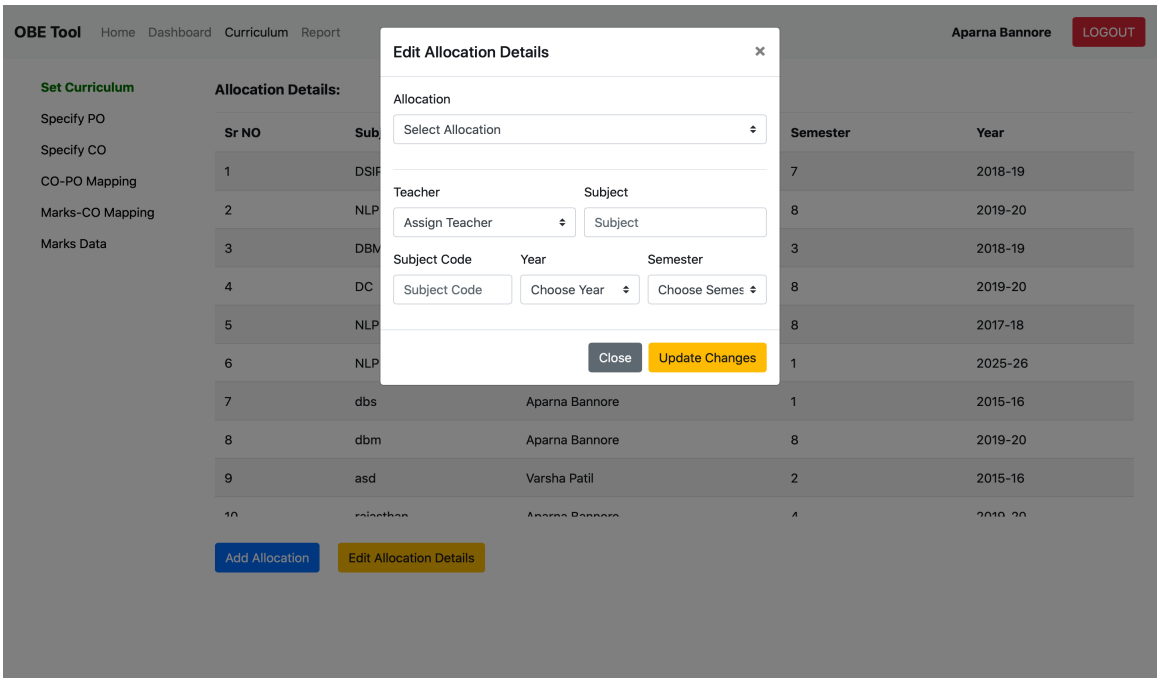

Fig 5.3 : Edit Allocation

After setting the curriculum, the next step is to specify the program and course outcomes. This can be done by heading over to the 'Specify PO' and 'Specify CO' sections of the Curriculum module. Functionalities to easily add and edit outcomes have been provided. The user can also use the 'View Specifications' button to display the CO and PO entries on the application itself.

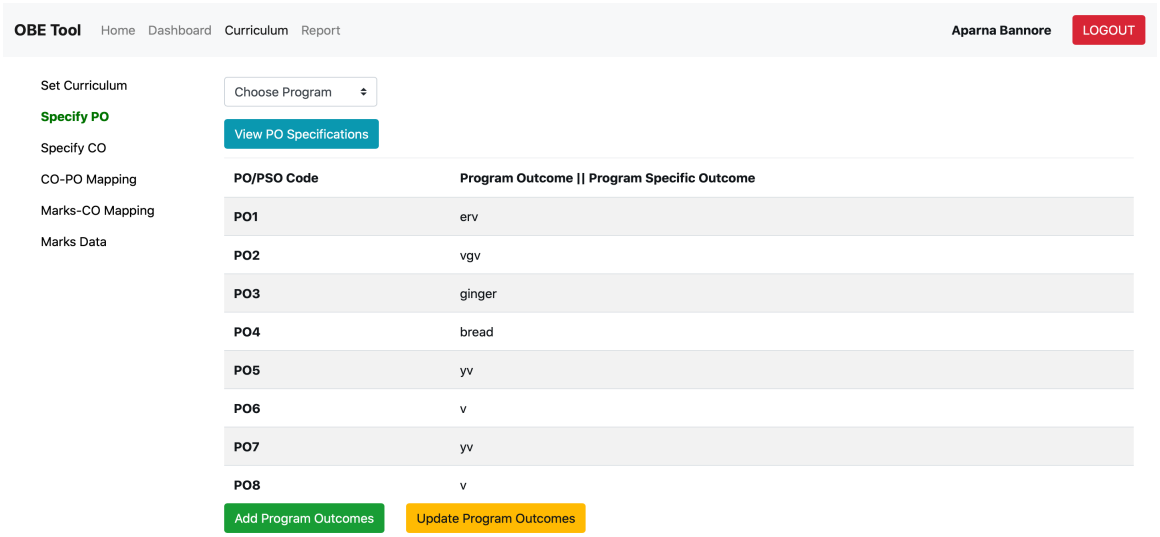

Fig 5.4 : Specify PO

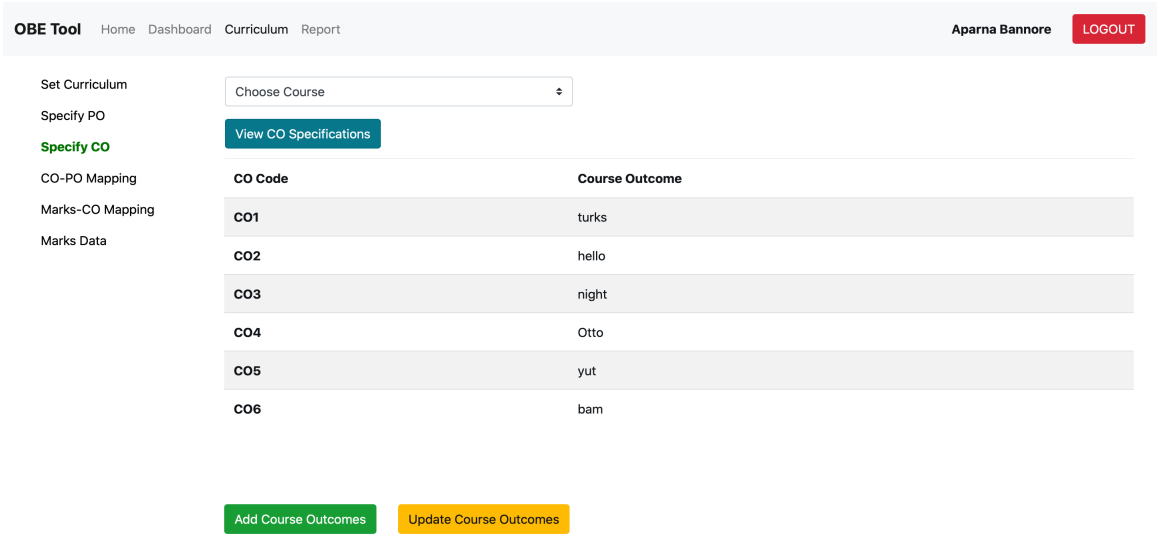

Fig 5.5 : Specify CO

The next step after stating the Program and Course Outcomes is to provide the CO to PO mapping. The HOD will head over to 'CO-PO Mapping' section of the Curriculum module to carry out this task. A mapping table has already been prepared for the user's convenience. The user has to only enter the attainment level corresponding to the related CO and PO. There are three attainment level 1,2 and 3 and information about them has been provided in Fig 3.3. The following figure shows how attainment levels can be easily filled to complete the CO-PO mapping.

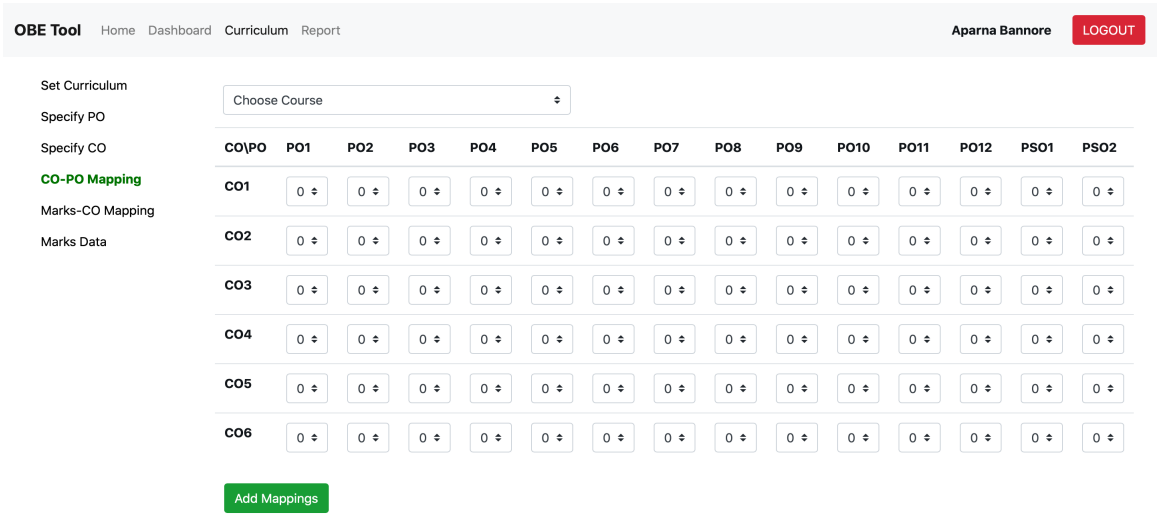

Fig 5.6 : CO-PO mapping

The next type of mapping which the user needs to provide is the mapping of marks in various assessments formats with the Course Outcomes. The OBE tool provides various forms of assessments like Unit tests, Semester exams, Oral exams etc. The user only needs to select the format of assessment from the drop down menu and fill the mapping into the given blanks. Clicking on the "Map' button stores the mapping into the database. The following snapshot depicts the 'Marks-CO Mapping' section of the Curriculum module.

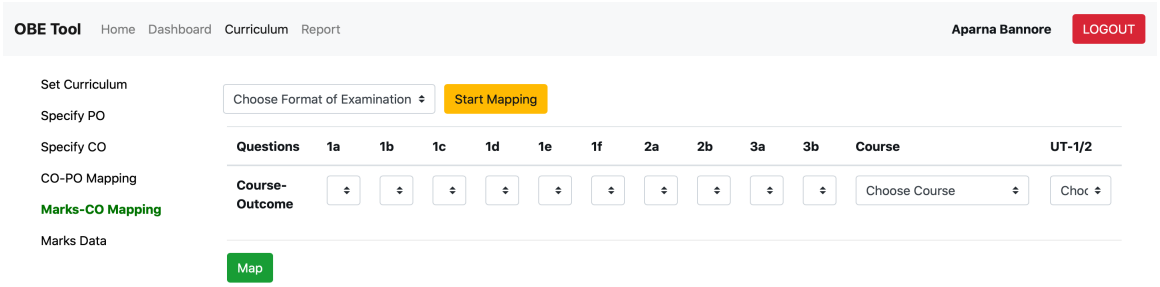

Fig 5.7: Marks-CO Mapping

The last process which the user needs to follow in the Curriculum module is adding a .csv file which contains the marks of the students. The calculation of mapping can only be done after receiving this piece of data. Fig 4.5 shows the Marks Data section of the Curriculum module. (This Figure can be found in Chapter 4). In order to assist the user, there is a help button marked with an 'i' which shows sample formats which the user needs to follow while uploading the .csv files.

This completes the steps which users need to follow in order to feed data via the Curriculum module. After this process, the user can head over to the Report Module to generate reports in whichever form desirable. The User can view collective data of all students in the form of bar graphs and pie charts. The user can also opt to generate the CO Attainment table and the PO attainment table by selecting these options on the left top corner of the Report module. The following two snapshots added depict the output i.e the calculate CO and PO attainment tables. The data which was used for this calculation was a test sample given to the OBE Tool.

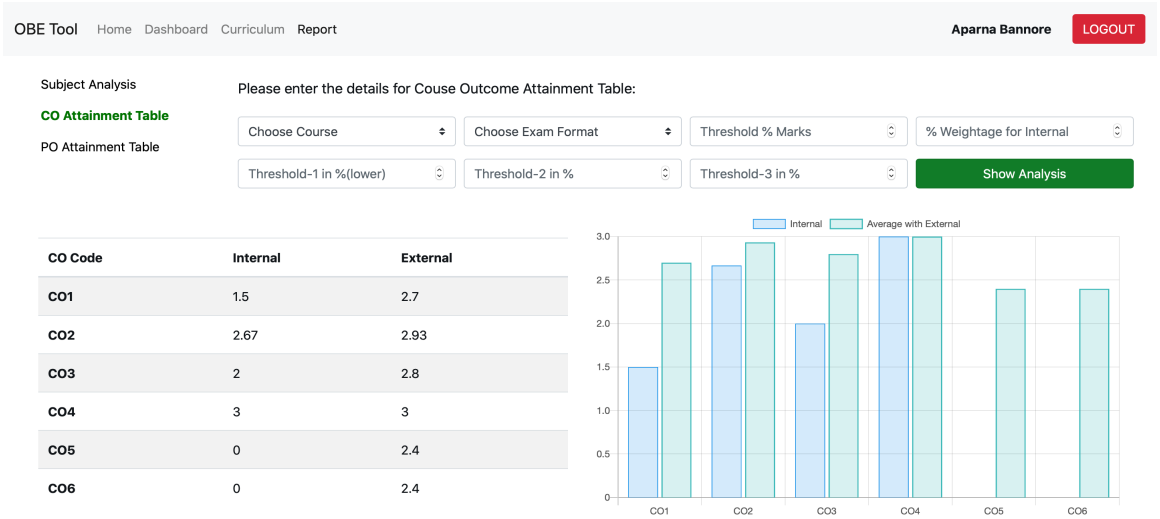

Fig 5.8: CO Attainment Table

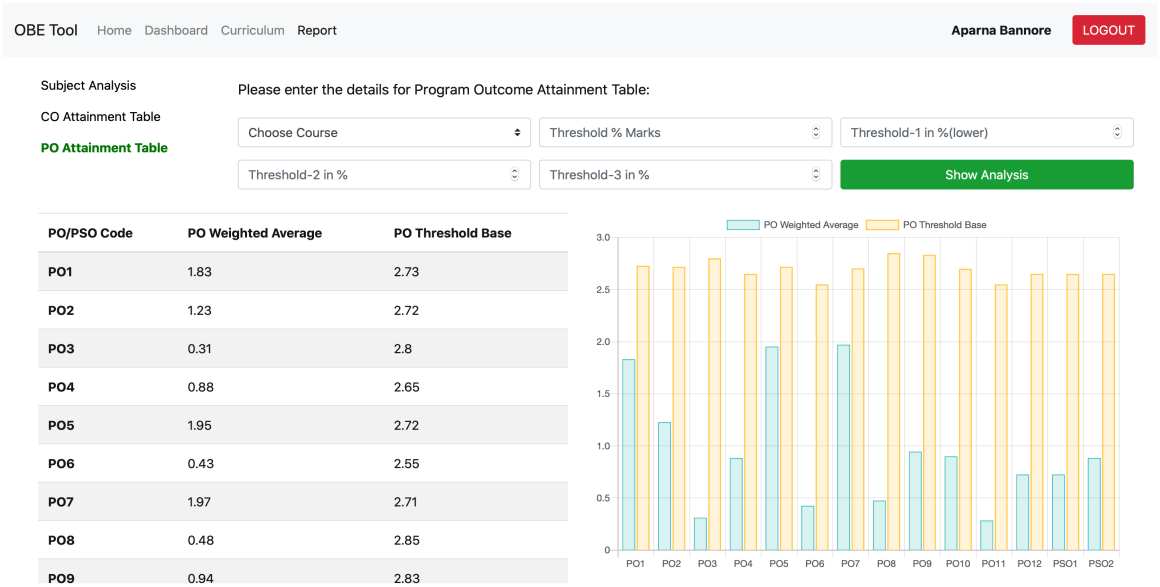

Fig 5.9: PO Attainment Table

6. CONCLUSION AND FUTURE SCOPE

Our country produces more than a million engineering graduates every year. But the important question which must be asked is about the quality of education these engineers have received. We all know that quality is more important than quantity. Outcome Based Education is one solution to measure the quality of education which institutes provide to students. In our country, agencies like the National Board of Accreditation (NBA), All India Council for Technical Education (AICTE) and National Assessment and Accreditation Council (NAAC) are striving to insure that students receive quality technical education. These agencies provide grade certificates to universities and colleges after thorough examination of all aspects. A grade certificate from these agencies acts a hallmark to judge universities and colleges from different perspectives.

This project also walks on the guidelines provided by the NBA and mainly focuses on the academics aspect. The OBE Tool has been made in-house for the sole usage for the institution. We have tried our fullest to study the IonCUDOS software as an existing system and create a similar tool, more user friendly and functionality specific as required by the teachers of our institution. The OBE tool is an attempt to automate a small part of the SAR report generation which is a pre-requisite for accreditation councils to judge the institution's performance.

The OBE Tool can prove quite effective to simplify and speed-up the report generation process for the teachers. Every university changes it's syllabus, examination patterns, etc to cope-up with new methodologies and technologies so that students receive knowledge about latest technologies. With changes in patterns and syllabuses, this tool can also be shaped in a manner befitting the requirements in a hassle free and easy way. Modifications and adjustments can be quickly made as this project is for in-house use.

7. REFERENCES

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[4] SELF ASSESSMENT (SAR) FORMAT, page 13
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