Table 6. Engineering Chemistry CO Attainment obtained for different branches.

	Branch	CO1	CO2	CO3	CO4
2016-17 (Odd Sem)	ISE-ODD	72.70	71.88	74.95	59.25
	ECE-ODD	81.13	79.36	75.14	65.57
	CSE-ODD	76.02	73.69	72.98	59.79
	EEE-ODD	71.58	68.08	72.74	54.79
	CH-ODD	69.28	65.26	59.46	47.85

An automated excel sheet is prepared to calculate Total CIE marks CO attainment and CO-PO mapping of Engineering Chemistry course. It also gives the grade status to encourage student for the SEE preparation. This excel sheet is customized for some of few other courses.

SEE CO Attainment

For SEE the CO attainment is done by the examination section because of confidentiality reason. The SEE CO attainment may not be as accurate as the CIE attainment for two reasons.

- In the question paper the marks distribution is not as per Achievable matrix.
- Sometimes exact mapping of the questions to COs are difficult.

Course end survey CO Attainment

Students respond online to course end survey questioner. In the questioner the questions are mapped to different COs. CO attainment is calculated using the same formula used for theory CO attainment calculation. The sample questioner used is given in **Table 7**.

Table 7. Course end survey questioner.

COs	Question No.	Question
1	Q1	How challenging was the subject matter?
1	Q2	How well was the course material organized and developed?
2	Q3	How helpful was the text book in increasing your understanding of the material?
2	Q4	How well the lab experiment helped in better understanding of the theory?
3	Q5	How useful the manual for calculation/analysis of data obtained during the conduction of experiment?
3	Q6	How useful were the home work, assignment in

		helping you to learn the course?
4	Q7	How well were the defined course outcomes of the course accomplished?
4	Q8	Did you find the input of the teacher motivating for further learning?
	Q9	How fare was the evaluation?
	Q10	Write your comments on the usefulness of the rse here?

The course end survey analysis is shown in **Table 8** and **Figure 4**.

Table 8. Course end survey analysis.

COs	Attainment %	Question No
CO1	79	1, 2
CO2	76	3, 4
CO3	81	5, 6
CO4	82	7, 8

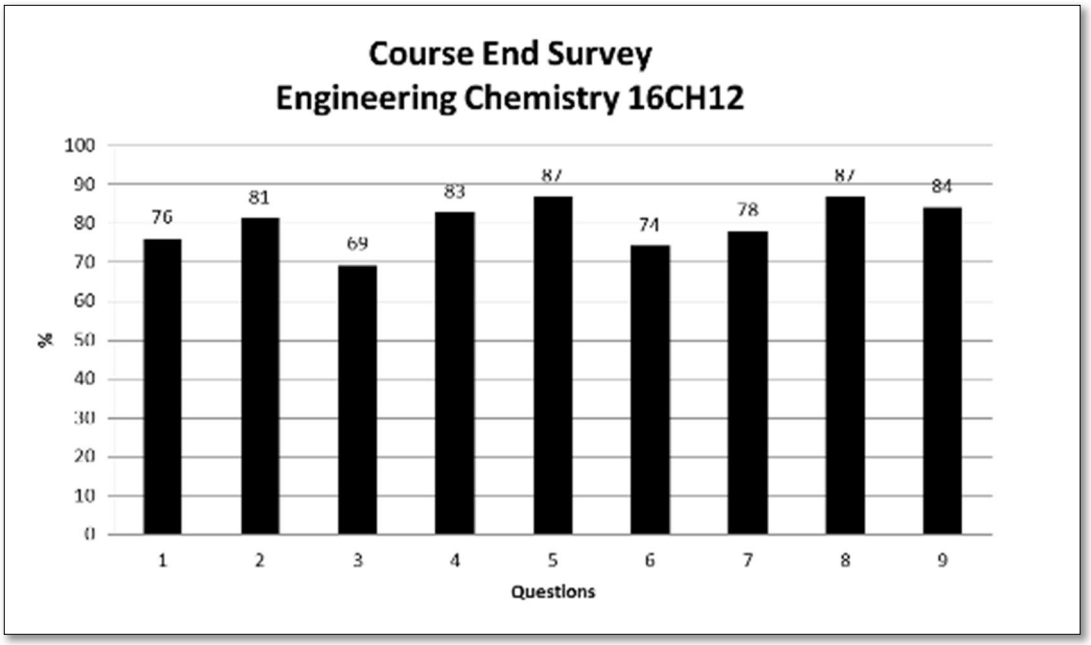

Figure 4. Course End Survey Analysis.

The final CO attainment is calculated from the attainments obtained from CIE, SEE and Course End Survey.

A = CIE CO Attainment (80%) + SEE CO Attainment (20%)

Final Attainment is calculated as: A (90%) + Course End Survey Attainment (10%)

CO-PO Mapping

For Engineering Chemistry course mapping of the four COs to Program Outcomes (POs) is given in **Table 9**.

Table 9. CO-PO Mapping Course Code 16CH12/22.

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	3											
CO2	3					2	2			1		
CO3		3		2								2
CO4			3			1	1					2
High-3						**Medium-2**					**Low-1**	

Using **Table 5** and **Table 7,** the contribution of COs to each PO is calculated and given in **Table 10**.

Table 10. Contribution of COs to each PO is calculated.

Branch 2016-17 Odd Sem	CO-PO1	CO-PO2	CO-PO3	CO-PO4	CO-PO5	CO-PO6	CO-PO7	CO-PO8	CO-PO9	CO-PO10	CO-PO11	CO-PO12
ISE	72.29	74.95	59.25	74.95	-	67.67	67.67	-	-	71.88	-	67.10
EEE	77.44	74.08	56.98	74.08	-	68.27	68.27	-	-	73.92	-	65.53
ECE	80.25	75.14	65.57	75.14	-	74.76	74.76	-	-	76.36	-	70.36
CSE	74.85	72.98	59.36	72.98	-	68.91	68.91	-	-	73.69	-	66.17
CH	67.27	59.46	47.85	59.46	-	59.46	59.46	-	-	65.26	-	53.66

Contribution of COs to each PO is obtained by taking average of all the branches to that particular PO. In the beginning the target must be set for the COs contribution to each PO. Action plan for the next academic session is decided by comparing the calculated CO contribution to PO with the target value in order to enhance the learning outcomes and quality of teaching - learning process.

CONCLUSION

To improve the quality of education and to get recognition across the globe, it is essential to get accreditation from different accreditation agencies. Each accreditation agency has its own set of criteria to assess the teaching and learning. The quality of teaching can be judged by measuring the learning outcomes. Following the method described in this paper it is observed that there is gradual enhancement of learning outcomes. It is also observed that the learning outcomes are better in blended mode of teaching compared to traditional method of teaching. Student's involvement is more in the class room to extract more information from the instructor. Instructor needs to decide how to implement the blended mode of teaching depending on the understanding level of student. Even though it is time consuming on the instructor's part to prepare the study materials and to keep pace with the advanced technology but the investment is worth.

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