ACADEMIC EXCELLENCE THROUGH ATTAINMENT OF COURSE OUTCOMES A CASE STUDY ON ENGINEERING CHEMISTRY

Swarna M Patra[1*], Ramakanth Kumar P[2]
[1]Assistant Professor, [2]Dean Academics
[1]Department of Chemistry, [2]Department of Information Science Engineering
R V College of Engineering, Mysore Road, Bangaluru 560 059, India

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Abstract: In Outcome-Based Education one of the key components is learning outcomes of the students. Learning outcome for each course is assessed through the course outcomes (CO). For each course the course outcomes are set from the Program outcomes and other requirements. Program outcomes are the twelve graduate attributes. COs are the measurable attributes which needs to be assessed at the end of successful completion of the course. Each course under the program has its own set of COs. In this paper we have discussed the process to measure the COs through a case study on Engineering Chemistry course. To expedite the analysis of course outcomes through CO attainment, an automated excel sheet is programmed. The programmed excel sheet can be used for other courses with necessary customization.

Keywords: Outcome based education, Course outcome attainment, Achievable Matrix

Introduction

Implementation of Outcome based Education has been popular for its potential to measure the learning outcomes[1]. OBE has adopted this process of measuring the learning outcomes from American Accreditation Board of Engineering and Technology (ABET)[2]. Importance of learning outcomes is increasing day by day due to the challenges of employability. The learning outcome attributes are derived from Bloom's taxonomy of education objective[3]. The attributes are knowledge, skill and attitude[4]. These attributes each individual must have attained at the end of successful completion of a program in higher education[5,6]. The learning outcomes are measured at different levels such as course outcomes, program outcomes etc. In this paper we have discussed the attainment of lowest level measurable learning outcome i.e. course outcomes. Depending on the expected outcomes of learner and delivery method suitable assessment methods have been chosen[2, 7-8]. The course outcomes are derived from institution vision in a step wise manner.Missions are steps through which institution vision can be achieved. From the institution vision and mission, department vision and missions are derived. Each department represents a program. Each program has its own Program Specific Objective (PSO) and program outcomes (POs). Under each program there are a number of courses. Corresponding to each course

Swarna M Patra
Assistant Professor, Department of Chemistry
R V College of Engineering, Mysore Road,
Bangalore - 560 059,
E-mail: swarnamp@rvce.edu.in.
Mobile: 9740746518

There are course outcomes defined which are linked to POs. Program Specific objectives are broad statements that describe the career and professional skills the students will be able to achieve under the program. For example there are three PSOs set for Information Science Department (ISE) of RVCE, which are given below.

PSO-1: Ability to identify, formulate and simulate problems in the area of Computer Networks and Information Security and software engineering.

PSO-2: Ability to apply analyze, design, develop, and test principles of System software and Database concepts for computer-based systems.

PSO-3: Ability to apply concepts of computer architecture and organization to meet desired needs of modern computer technology.

It is essential to get accreditation from different agencies to improve the quality of teaching and to get recognition throughout the globe. 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.

The learning outcomes of a program are more specifically defined in terms of program outcomes. There are twelve graduate attributes which are defined as the Program Outcomes (POs) for all the programs. POs are common for all the departments. The twelve POs are

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PO1-Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems

PO2-Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO3-Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

PO4-Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the 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 modeling to complex engineering activities, with an understanding of the limitations.

PO6-The engineer and society: Apply reasoning informed by the contextual knowledge to assess Societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7-Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8-Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9-Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10-Communication: Communicate effectively on complex engineering activities with the engineering community and with the 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.

PO11-Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12-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.

These are the expected program outcomes a student should have after successful completion of the course. Attainment of POs is done through course outcomes of all courses under the program. PO attainment discussion is beyond the scope of present paper.

Course outcomes are the measurable outcomes which are set to measure after successful completion of the Engineering Chemistry. This is a basic course required by all the Engineering branches. For Engineering Chemistry there are four COs.

•**CO1** - Understanding the principles of Chemistry in Engineering & Technology

•**CO2** - Applying the knowledge of Chemistry in solving socio-economic and environmental issues

•**CO3** - Identifying and analyzing Engineering problems to achieve practical solution

•**CO4** - Developing solutions for problems associated with technologies

These are four COs included in each unit. In this paper we have described the method how to measure these COs through CO attainment (COA).This gives the idea regarding the depth of understanding of the course and critical thinking to solve new problems. COs are defined at the student level, whereas from teaching point of view at the beginning of the semester teachers prepare their lesson plan along with course learning objective (CLO). For Engineering Chemistry following are the CLOs.

Describe the basic concepts of chemistry behind the development of futuristic materials for various applications in Engineering and technology

Explain the Chemistry and processes involved in development of alternate and sustainable energy sources.

Learn to apply the knowledge of behaviour of materials that play a vital role in selection of materials and design of products in Engineering.

Assessment Process

Assessment process is critical component to achieve academic excellence. Assessment is done by two ways i.e formative assessment and summative assessment. Formative assessment is done during the instructional or teaching process to gather information and also to adjust teaching and learning in real time[8]. In this paper we have presented the summativeassessment process, which is used by Department of Chemistry RVCE. The flow chart of assessment process is given in Figure 1.

Summative Assessment

The summative assessment is done in two ways:

1. Continuous Internal Evaluation (CIE).
2. Semester End Evaluation (SEE).

Final grade of the student is calculated based on CIE and SEE. CIE and SEE both are calculated out of 150 marks. CIE consists of theory for 90 marks (two best unit test out of three unit test), assignment/presentation for 10 marks and lab component for 50 marks (experiments and lab internal). In lab component experiments are valued out of 200 marks and lab internal is conducted out of 50 marks. Total 250 marks of lab component is reduced to 50 marks for CIE calculation. In each unit test the question papers are set according to the achievable matrix. However all the three unit tests are considered for the calculation of Course Outcome Attainment (COA).

Achievable Matrix

Achievable Matrix is set up at the beginning of the semester. In this matrix the total theory marks (90) for CIE is distributed among all the units and COs of the course. Setting up of achievable matrix helps to set up the question paper according to Bloom's Taxonomy level for each unit test. This covers the assessment of student's knowledge; understanding, analysis and designing capabilities. For Engineering Chemistry 12CH12/22 there are five units. Distribution of marks among the units and unit test is given in table 1.From Table 1 the marks distribution for all the units 1 to 5 is 20, 20, 18, 14 and 18 respectively. Then these marks for each unit are divided among CO1, CO2, CO3 and CO4. By adding the CO1 contribution for all five units, it gives 16. Similarly for CO2, CO3, and CO4 we get 29, 31 and 14. These COi (i=1 to 4) number indicates the distribution of marks for each individuals CO out of 90 for CIE. After rounding up of the percentage of CO contribution for CIE, we obtained CO1, CO2, CO3 and CO4 contribution for all the three unit test are as follows 18%, 32%, 35% and 15%. Sum of all the CO percentage contribution is 100.

The detailed marks distribution (target and actual) for each unit test is given in Table 2. Target CO% is obtained from Table 1. Table 2 gives clearly the syllabus portion for each unit test and CO contribution also. Corresponding to each unit test the target percentage of CO and CO marks distributions are given in bold and below which the actual CO percentage distribution and marks are given.

A model question paper for unit test I is given in Appendix 1. The unit test question paper has two parts. Part A contains quiz questions and Part B contains test questions. For each question the marks, Bloom's Taxonomy level and corresponding CO is given in the right hand side. The question paper also contains the course outcome as per Bloom's Taxonomy level. These details help to set up question paper mapping with CO and course outcome attainment.

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Question Paper Mapping Matrix (QPMM)

The dimension of QPMM is given by Number of questions X Number of COs. The matrix elements are 1 and 0. Matrix Element = 1, if the question belongs to the particular CO, Matrix Element = 0, if the question does not belong to the particular CO. The question Paper Mapping Matrix for the model question paper is given in Table 3. It also contains the maximum marks corresponding to each quiz/test question. After the QPMM is set up for each individual student the detailed marks entry for each quiz/test question is done to calculate the theory CO attainment for the particular unit test.

After the unit test the QPMM is set up for the question paper and marks for all questions of each student is entered to calculate theory CO attainment. For the model question paper the marks entered are given in Table 4.Dimension of the matrix = (number of questions X number of students). Corresponding to each question column of Table 3 marks are entered as shown in Table 4.

CO attainment for each student is calculated from Table 3 and 4.

CO*i* attainment is calculated by (where *i* = 1 to 4) the formula given below:

For all the three unit test theory CO attainment is calculated separately and average of all the three CO attainment is taken as the theory CO attainment. For Lab component and assignment/presentation the CO attainment is calculated as per the rubrics.

Rubrics for Laboratory and Assignment/Presentation

Laboratory component contains the practical skill along with understanding, analysis and design component. Laboratory component assessment is done by indirect method based on rubrics. Rubrics are set of criteria used to assess the complex learning outcomes. Assessment of oral presentation, writing skill and critical thinking for designing is done using rubrics.

The different components of the lab experiment and presentation is mapped to CO1, CO2, CO3 and Co4.Co1 and CO2 corresponds to the "Remember" and "understanding level" of Bloom's Taxonomy level, CO3 corresponds to "Analysis" and CO4 correspond to the higher order skill "create".

For 12CH12/22 laboratory component the rubrics components are as follows

1. Title
2. Purpose and objectives
3. Design and Hypothesis
4. Materials and Devices
5. Procedure
6. Analysis and Inference
7. Creative idea & Applications

There are total of ten experiments in 12CH12/22. Out of ten experiments six are instrumental analysis and four experiments are volumetric analysis. Assessment of these experiments is done by mapping the rubric components to course outcomes. For example rubric component from one to sis ix mapped to CO1, CO2 and rubric component six and seven are mapped to CO3 and CO4 respectively. The detailed marks entry for all the experiment for each student is given in Table 5. Table 5 shows the model marks entry for the laboratory experiments. For each experiment marks are entered as per the rubrics.

Lab CO*i* attainment (where $i = 1$ to 4) is calculated by the formula

Similarly for assignment/presentation the rubrics components are

1. Understanding the topic
2. Technical content
3. New Technologies discussed
4. Applications discussed
5. Communication & QA skill
6. References

Rubrics component one and six are mapped to CO1, rubrics component two and three are mapped to CO2, component number four is mapped to CO3 and component five is mapped to CO4. Table 6 shows the marks entry for assignment/presentation for each student as per the rubrics.

Table 6 shows the CO attainment for assignment/presentation. Provisional CIE grade and CO attainment is done using an automated programmed excel sheet. Table 7 shows the provisional CIE grade calculation. This excel sheet can be used by customizing it according to their course. Average of all the theory, lab and assignment/presentation CO attainment gives the final CO attainment of the student, as shown in Table 8.

Result Analysis

The final CO attainment of a particular branch is calculated by taking the average of each CO attainment of all students of a particular branch. Further this CO attainment is used for CO to PO mapping. In this paper we are not discussing the CO to PO mapping. The CO attainment obtained is compared with the target CO attainment, which was set at the beginning of the semester along with the achievable matrix. We have observed even if the result is 100 percent, CO attainment isn't necessarily 100 percent. Over a period of time how the CO attainment is obtained is given in Table 9 and Figure 1.

From this table we observe that there is very little variation in the CO attainment of CSE branch for the first three semesters. For 2015-Odd semester there is remarkable improvement in the CO attainment. This is due to the change in assessment pattern of Laboratory and assignment/presentation component. The assessment is done using the rubrics which we have already discussed. Setting up of rubrics help to capture more correctly the different course outcomes learned by the students. It is always a challenge to set up the correct assessment plan in order to capture the learning capabilities, where directly the capabilities are not quantified. A better representation of these data is given in Figure 2.

This leads to think and set the action plan to improve the learning capabilities of the student and teaching skill of the teacher. Teaching skill includes lesson plan, assessment and curriculum design. In the present paper we are focusing only on the lesson plan and assessment component. The course co-coordinator, examination coordinator and teaching faculties collectively take the feedback from the student and course end survey to set up the action plan for the next academic session. The sample questioners for student feedback and course end survey are given in Appendix 2. In the course end survey there are ten questions. These questions are divided into two categories as curriculum (question no 1 to 5) and teaching (question no 6 to 10). Curriculum component analysis is taken as the input for curriculum design. Teaching component analysis with student feedback analysis is considered for improvement of teaching methodologies and assessment.

Conclusion

Refining the assessment pattern captures the course outcome attainment or what the student has learned. Grade calculation is done by considering two best unit test but CO attainment is calculated from all the three unit test. Three unit tests covers 100 % syllabus. The definition or meaning of course outcome is what the student has learned after successful completion of the course. So far we have calculated CO attainment for all the students but from the next academic session we will be calculating the CO attainment for the students who are eligible to appear SEE. Educating the significance of course outcome to students increases their learning and critical thinking capabilities. RVCE has lot of potential to change the teaching and assessment process as it is an autonomous institute and following outcome based education. Continuous training for teaching/ non-teaching to enhance their skill, modern facility/equipment in the laboratory will definitely help to achieve the vision of RVCE. At each and every step there should be correct process to quantify the target and to check the accountability. This simple method of quantifying course outcome attainment is definitely one such process. More research can be done in this area to increase the awareness and learning. This process definitely benefitsthe growth of learner, teacher and institute.

Acknowledgement

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TABLES

Table 1: Achievable Matrix for 12CH12/22

	CO1	CO2	CO3	CO4	Total Marks
Unit1	4	6	8	2	20
Unit2	4	8	6	2	20
Unit3	3	3	8	4	18
Unit4	2	5	5	2	14
Unit5	3	7	4	4	18
Total	16	29	31	14	90
Achievable	17.78%	32.23%	34.45%	15.56%	100

Table 2: Marks Distribution in Unit Test Using Course Achievable Matrix

	CO1 %	CO2 %	CO3 %	CO4 %	Total Marks	CO1 Marks	CO2 Marks	CO3 Marks	CO4 Marks
Achievable Matrix	**18**	**32**	**35**	**15**	**Target CO%**				
Unit Test 1 (unit 1 + unit 2a)	**6**	**12**	**12**	**5**	**65**	**11.2**	**22.3**	**22.3**	**9.3**
	8	10	13	4	65	15	19	23	08
Unit Test 2 (unit 2b + unit 3)	**7**	**10**	**11**	**5**	**65**	**13.8**	**19.7**	**21.7**	**9.9**
	10	10	10	3	65	34	38	44	14
Unit Test 3 (unit 4 + unit 5)	**5**	**10**	**11**	**5**	**65**	**10.5**	**21.0**	**23.1**	**21.5**
	3.5	12	12	8	65	8	23	21	13
Achievable Matrix	21.5	31	33	14	Actual CO%				

Table 3 Question Paper Mapping Matrix (QPMM

UNIT TEST - I	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Q 7	Q 8	Q 9	Q 10	Q 11	T1 A	T1 B	T2 A	T2 B	T3 A	T3 B	T4 A	T4 b	T5 A	T5 B
CO1	0	0	1	1	0	0	1	1	0	0	1	0	0	1	1	1	1	0	0	1	0
CO2	0	1	0	0	0	1	0	0	0	1	0	1	0	1	0	0	0	1	1	0	0
CO3	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1
CO4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Max Marks	1	1	1	1	1	1	1	2	2	2	2	6	4	6	4	6	4	6	4	6	4

Table 4 Detailed Marks Entry

SUHAS P	0	1	1	0	1	1	0	2	0	2	2	5	0	3	0	4	0	1	1	5	4
SUMAN RAJ VENKAT	1	1	1	1	1	1	0	2	1	2	2	5	0	3	2	0	3	2	2	4	3
SUMANTH KUMAR M G	0	0	0	0	0	1	0	1	0	1	0	4	4	4	2	0	4	1	0	3	4
SUMANTH M S	0	1	0	1	0	1	0	0	1	2	2	5	1	3	2	3	1	6	0	5	3
SUMIT KUMAR	1	1	1	0	1	1	0	0	2	1	2	4	0	3	2	2	1	1	2	2	3
SUPRIYA ARUN	0	1	1	0	1	1	0	1	0	0	2	4	0	3	1	1	2	1	0	2	4

Table 5: Detailed Lab Marks Entry

USN	Name of the student	Burette Reading (BR)	Calculation	Internal Assesment/ Evaluation (IE/IA)	**THW**	pKa Value	Graph	Internal Assesment/ Evaluation (IE/IA)	**pKa**
1RV15TE001	ABHIRAJ BISWAS	12	3	4	**19**	8	7	4	**19**
1RV15TE002	ACHYUTHA VENUGOPAL	5	3	5	**13**	8	6	4	**18**
1RV15TE003	ADITYA VIKRAM	11	3	3	**17**	8	7	4	**19**
1RV15TE004	AISHWARYA R K	7	3	4	**14**	8	7	4	**19**
1RV15TE005	AKASH VARMA	12	3	2	**17**	8	6	1	**15**
1RV15TE006	AMIT JAGADISH SURE	8	3	4	**15**	8	7	4	**19**

Table 6: Detailed Marks Entry for Assignment/Presentation

Sl.No	USN	Name of the student	Topic	Presentation/Assignment	Introduction (CO1)	Methodology (CO2)	Analysis (CO3)	Conclusion, presentation/ communication skill	TOTAL	Attainment ACO 1	ACO 2	ACO 3	ACO 4
Full Marks					3	3	2	2	10				
1	1RV15TE001	ABHIRAJ BISWAS	Rocket Propellant	A	3	3	2	1	9	100	100	100	50
2	1RV15TE002	ACHYUTHA VENUGOPAL	Nanomaterials	S1	2	1	1	1	5	66.7	33.3	50	50
3	1RV15TE003	ADITYA VIKRAM	Nanomaterials	A	3	2	2	1	8	100	66.7	66.67	33.33
4	1RV15TE004	AISHWARYA R K	Nuclear Power Plant	A	3	3	2	1	9	100	100	66.67	33.33

Table 7: Unit Test Marks and Provisional CIE grade

Name	Q1	T1/50	T1/30	QT1	Q2	T2/50	T2/30	QT2	Q3	T3/50	T3/30	QT3	Best	A	Total 100	LAB	Total 150	CIE Grade
ABHIRAJ BISWAS	13.0	41.0	24.6	37.6	9.0	49.0	29.4	38.4	6.0	40.0	24.0	30.0	76.0	9.0	85.0	45.8	131	Grade-A
ACHYUTHA VENUGOPAL	5.0	24.0	14.4	19.4	3.0	23.0	13.8	16.8	10.0	18.0	10.8	20.8	40.2	5.0	45.2	43.8	89	Grade-C
ADITYA VIKRAM	7.0	36.0	21.6	28.6	13.0	44.0	26.4	39.4	8.0	40.0	24.0	32.0	71.4	8.0	79.4	39.0	119	Grade-A
AISHWARYA R K	9.0	35.0	21.0	30.0	14.0	39.0	23.4	37.4	12.0	43.0	25.8	37.8	75.2	9.0	84.2	46.4	131	Grade-A

Table 8Final CO attainment

Roll no	**USN**	**Name**	**CO1A**	**CO2A**	**CO3A**	**CO4A**
1	1RV15TE001	ABHIRAJ BISWAS	99	87	87	70
2	1RV15TE002	ACHYUTHA VENUGOPAL	70	53	64	56
3	1RV15TE003	ADITYA VIKRAM	90	71	74	51
4	1RV15TE004	AISHWARYA R K	86	91	82	65
5	1RV15TE005	AKASH VARMA	31	34	31	12

Table 9: CO attainment for CSE branch

	2013-EVEN	2014-EVEN	2014-ODD	2015-ODD
CO1	69.12	69.13	69.62	82.24
CO2	74.23	69.08	70.61	81.47
CO3	75.16	69.52	68.99	81.56
CO4	75.67	68.13	71.85	69.81

FIGURES

Figure 1: Flow chart of Summative Assessment Process

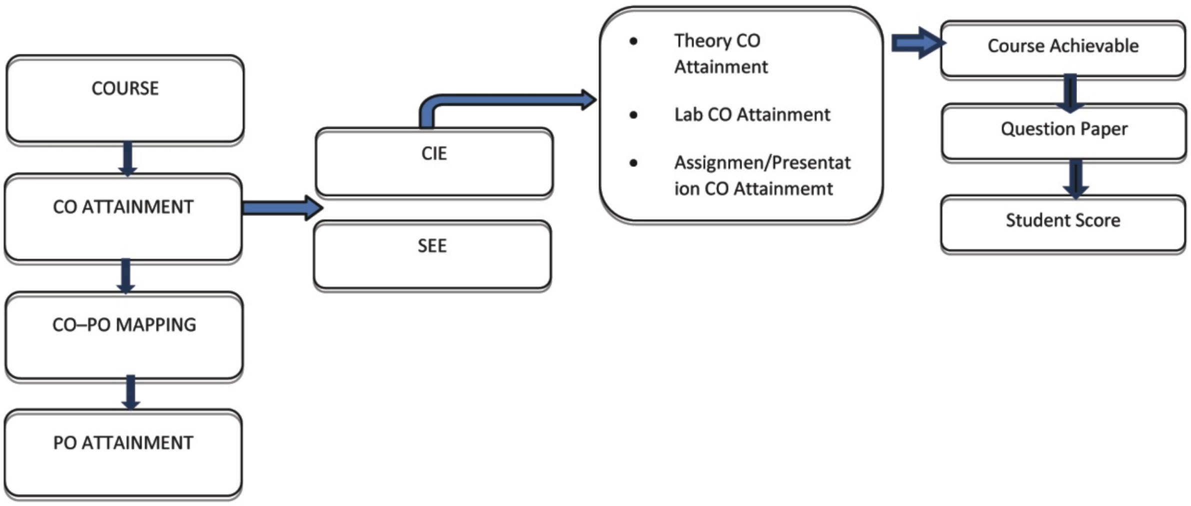
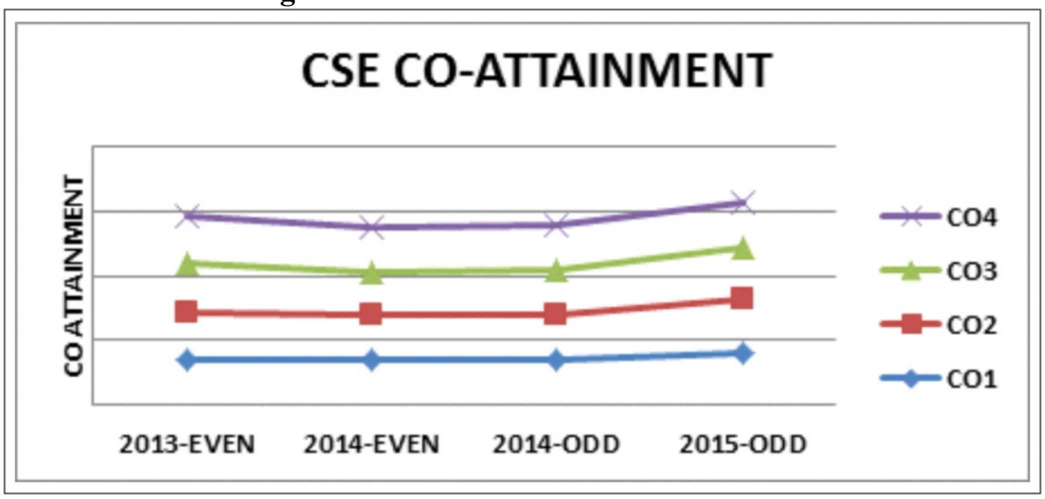


Figure2: CO attainment for CSE branch



Appendix 1

R.V. College of Engineering
(Autonomous Institute affiliated to VTU)
Department of Chemistry
Engineering Chemistry(12CH12)
(Unit Test-I)

Date: 11.09.2015 **Duration: 2.0 Hours** **Max Mark: 65**

Instructions:(i) Answer ALL the questions from part-A and Part-B.
(ii)Part-A carries 15 marks and Part-B carries 50 marks.
(iii)Part-A questions should be answered in first two pages of the booklet.

PART-A

Sl No	**Questions**	Marks	BT	CO
1	How many grams of Magnesium sulphate dissolved per litre give 220 ppm of hardness? (molecular weight of Magnesium sulphate=120)	1m	L3	3
2	Define single electrode potential	1m	L1	2
3	What are Rocket Propellants?	1m	L1	1
4	Write any requirements for secondary reference electrode?	1m	L2	1
5	What is self-discharge of a battery?	1m	L1	3
6	Write any one effect of high concentration of fluoride content in water sample	1m	L2	2
7	Name the electrolyte used in the Li-MnO_2 battery	1m	L1	1
8	What is Reserve battery? Give one example	2m	L2	1
9	Calculate the heat associated with steam when 16.6g of fuel containing 8 % of hydrogen undergoes complete combustion and products are allowed to escape.	2m	L2 & L3	3
10	Define of BOD of water sample	2m	L1	2
11	Write any two disadvantages of Glass electrode	2m	L1	1

PART-B

13	**a**	Explain the construction and working of Lead acid battery.	06	L2	2
	b	25cm^3 of waste water reacted with 15 ml of 0.25 N $K_2Cr_2O_7$ and after the reaction, the un-reacted dichromate required 18 cm^3 of 0.1N FAS solution. Under identical condition 15 cm^3 of $K_2Cr_2O_7$ mixed with 25 cm^3 of distilled water required 30 cm^3 of 0.1N FAS. What is the COD of the wasted water sample?	04	L3	3
14	**a**	Derive Nerst equation for single electrode potential	06	L2	
	b	Explain knocking in IC engines by considering the following factors i) Chemical structure ii) self Ignition	04	L2	1
15	**a**	What are metal-insoluble salt electrodes? Write the construction and working of one such electrode	06	L1 & L2	1
	b	Briefly explain the following i)Cetane number ii) Octane number	04	L1	1
16	**a**	Describe the SPADNS method of determining fluoride in the water sample	06	L2	2
	b	How do you synthesize Biodiesel in the laboratory?	04	L1	2
17	**a**	Explain the following characteristics of a battery i) Capacity ii) cycle life	06	L2	1
	b	Copper electrode containing 1 X 10^{-4} copper sulphate and silver electrode containing 1 X 10^{-3}M silver nitrate were coupled using salt bridge. i)Represent the cell ii) write the cell reactions and calculate the emf at 20.9°C The standard reduction potentials of silver and copper electrodes are 0.8V and 0.3V respectively.	04	L3	3

..........END……….

Course Outcomes (As per Bloom's revised taxonomy)
1. Understand the principles of Chemistry in Engineering. 2. Applying the knowledge of Chemistry in solving socio-economic and environmental issues. 3. Identify and analyze Engineering problems to achive practical solutions. 4. Developing solutions for problems associated with technologies.

Appendix 2

Student Feedback - Department of Chemistry, RVCE

Course Name: Engineering Chemistry **Course Code: 12CH12/22**
Academic year: 2015-2016 (odd/even semester)

Note: Please fill in your feedback rating as 4/6/8/10 for all the faculties in the column next to the questions.

	Branch Name:	***Section:***	***Batch:***	***Theory teacher initial***	***Lab teacher initial***	
Sl no	Evaluation Based on					
1.	What is the clarity with the teacher explains the concepts in subject?					
2.	Does the teacher encourage questions and invite discussions in class?					
3.	How much of the class time does the teacher use for teaching the subject?					
4.	How punctual is the teacher to classes?					
5.	How often does the teacher use practical example to drive home concepts?					
6.	How often the teacher gives information about the developments in the subject?					
7.	Does the teacher encourage questions and clarifications outside class hour?					
8.	What is the overall effectiveness of the teaching learning process in class?					

Department of Chemistry, RVCE
Course End Survey for odd/even semester 2015-2016
Course: Engineering Chemistry (Theory & Lab), Subject code: 12CH12/22

	Questions	Well above average (5)	Above average (4)	Average (3)	Below average (2)	Well below average (1)
1. CO1	How challenging was the subject matter?					
2. CO4	How well were the defined course outcomes of the course accomplished?					
3. CO4	How useful were the home work, assignments in helping you to learn the course ?					
4. CO2	How helpful was the text book in increasing your understanding of the material?					
5. CO1	How well was the course material organized and developed?					
6. CO4	Did you find the input of the teacher motivating for further learning?					
7. CO2	Was the teacher well prepared for the class?					
8. CO3	How was the accessibility of the teacher for individual assistance?					
9.	How fare was the evaluation?					
10.	How effective was the response of the teacher for the questions in class?					
	Write your comments on the usefulness of the course here					

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