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Attainment of Program Outcomes of Audit Course: Environmental Studies

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Abstract: ***An audit course is meant for students to enrich, gain insight and explore horizons, without being assessed or appraised for what is learnt in the classroom. Environmental Studies is an audit course offered in the third year of Engineering Education. Although the course does not count towards the final Grade Point Average, for the attainment of Program Outcome all the courses of the program must map with the POs. In this process of mapping the core theory courses of the program generally map with Program Outcomes PO1-PO4. The Course Outcomes of audit course Environmental Studies maps well with the Program Outcomes PO6-PO12 excluding PO11. This review paper documents the mapping of CO-PO of the audit course Environmental Studies with justifications for correlation with Program Outcomes PO6-PO12, excluding PO11. Thereby stating the importance of the course in the curriculum structure, in the acquiring the competencies required for graduate attributes and in the attainment of Program Outcomes for an Engineering Program. As this course is important in the attainment of PO6-PO12 (excluding PO11) this work can be further worked upon to specify certain specific practices/ techniques and topics required to be included in the Environmental Course which will equip the student for application in the final year courses of seminar, project and internships, and map with POs with a high correlation factor, leading to higher level of PO Attainment.***

Keywords: Audit course, outcomes, attainment, mapping

1. Introduction

Program Outcomes are the statements that state what the student will be able to do on successful completion of the course. These are the statements of the graduate attributes of knowledge, skills and attitude which are specific, measurable and assessable. These are the competencies acquired by the student on graduating from the program. The Program Outcomes are a reflection of the graduate's ability to demonstrate the application of the fundamental knowledge and understanding of Basic sciences, Engineering science and humanities in core courses, electives and projects. The Program Outcomes are attained if the student acquires the competencies specified at the time of graduation. Together with social responsibility, environment sustainability, adherence to ethical principles and finance and management skills, the student will be able to pursue higher studies or become an entrepreneur.

2. Methodology

1) Overview of core courses mapping with POs.
2) Examine the alignment of the Environmental Studies course Syllabus and course outcomes with specific POs.
3) Calculating the CO attainment and mapping the the CO-PO Matrix.
4) Observations and Conclusions.

3. Overview of core courses mapping with POs

The core courses of the Program constitutes to about 75% of the curriculum structure as represented in the table below:

Curriculum component	(% of total credits of the program)	contact hours per week	credits
Basic Sciences	5.33	8	8
Engineering Sciences	1.33	2	2
Humanities and Social Sciences	1.33	2	2
Program Core	74.68	50	112
Program Electives	10	15	15
Open Electives	-	-	-
Project(s)	6	8	9
Internship/Seminar	1.33	8	2
Total number of Credits	100		150

These core courses of the Program are based on the application of the knowledge of mathematics, science, engineering fundamentals, to the solution of engineering problems which correspond to Program Outcome 1. The study of the core courses also include the identification, formulation, review of research literature, and analysis of engineering problems which corresponds to Program Outcome 2. The Design solutions for complex engineering problems and design system components or processes, that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations which are the parts of the core course in the program corresponds to Program Outcome 3. The component of the core courses which include the Conducting Investigations of complex problems Using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions correspond to Program Outcome 4. The elective courses, seminar, Internships and Final Year projects correlate with a high factor to Program Outcome 5, in addition to PO1-PO4, as it includes Creation, selection, and application of appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities.

This CO-PO mapping pattern of the Core courses is generally true for the curriculum components of Basic Sciences courses, which constitutes for 5-6% and Engineering Science courses which constitutes for 1-2% of

the curriculum structure. With varying factors of correlation the core courses, Basic Sciences and Engineering Sciences map well with PO1-PO4.

2. Examine the alignment of the Environmental Studies course Syllabus and course outcomes with specific POs.

Unit 1
Environment: Definition, Eco system – Balanced eco system, Effects of human activities on environment – Agriculture – Housing – Industry – Mining and Transportation. 4hrs

Unit 2
Natural Resources : Water resources, Availability and Quality, Water borne diseases, Water induced diseases, Fluoride problem in drinking water Mineral resources – Forest resources – Material cycles– Carbon, Nitrogen and Sulphur cycles. 8hrs

Unit 3
Pollution, Effects of Pollution : Water pollution, Air pollution– Land pollution-Noise pollution.8hrs

Unit 4
Current Environmental Issues of importance : Acid Rain, Ozone layer depletion – Population growth climate change and global warming, Environmental impact assessment and sustainable development. Environmental protection – Legal aspects, Water act and Air act. Legal aspects, Water act and Air act. 6 hrs

The Unit I of the syllabus covers the topics on the impact of the engineering solutions on the Environmental Issues encompassing the society and the need for sustainable development which correlates well with the PO6 and PO7. The Environmental Protection and Legal aspects covered in the syllabus in Unit 4 align with the PO8 of the commitment to Professional Ethics and norms of engineering practice. As no specific prerequisite is required for this course, there scope for introducing various skills like reading, writing, presenting, team work, Self Reflection and such activities as part of the course which align with PO10 as well as PO12.

Course Outcomes:

CO	Statement	POs
CO1.	Apply with understanding of the dimension of the societal health, safety, legal and cultural issues as engineer to the given Engineering problem of environmental concern.	PO6 PO8
CO2.	Evaluate the need for sustainable development having studied the adverse effects of present day development on the environment and by Self reflection on the individual day to day practices	PO7 PO12
CO3.	Develop and present report effectively as an individual, member/ leader of the team on the optimal use resources at individual and group level using modern tools.	PO5 PO9 PO10
CO4.	Adopt Lifelong practice of learning by experiential learning / contemplating about the role and responsibility towards the environment and practice in his/ her life.	PO8 PO12

Calculating the CO attainment and the mapping the CO-PO Matrix

Steps involved :

- COs are defined by the faculty in charge of the course. The statements should be specific, measurable and attainable. The verbs of the Blooms taxonomy is used to frame the CO statements. There should be a fair measure of the cognitive, psychomotor and the affective skills that the student shall acquire at the end of the course.
- COs are then mapped with the POs by the faculty based on the strength of the relationship of the CO with the corresponding POs. All Cos will not necessarily map with all the POs.
- The assessment for CO is designed and the weightage for CO assessment is set.
- The correlation factor for each of the CO is obtained.
- CO attainment is calculated by direct and indirect method.

Mapping of COs with the POs, by plotting the correlation factor Assessment and evaluation is carried out for obtaining the achievement of the course outcomes. Attainment is the action or fact of achieving a standard result towards accomplishment of desired goals. It is the standard of academic attainment as observed by test result. Assessment methods are categorized into two as direct method and indirect method to access CO's and PO's. The direct methods display the student's knowledge and skills from their performance in the continuous internal assessment tests, activities and semester end examinations, which give a proof of the student learning, thereby CO attainment. The indirect method done through course end survey of student's learning, by asking the student to do self reflection on his/ her learning of the course.

Direct assessment method and indirect assessment method are considered for 80% and 20% weightage respectively for calculating the attainment of the course outcome.

CIE 1 Question Paper OBE ANALYSIS						
Course Name : EVS (Audit course) Department : Humanities						
Course Code : HS006 Max Marks : 20						
Question	1	2	3	4	5	6
Blooms Level	L1	L2	L2	L1	L2	L5
CLO	CLO 1	CLO 1	CLO 1	CLO 2	CLO 2	CLO 4
Max Marks	5	5	5	5	5	5
4MC14CS007	3.5	3.5		4		4
4MC15CS024	4			4	2	

4MC17CS409		2.5	3.5	4		4
4MC17CS410	3.5	3	2.5			
Average Marks	3.42	3.38	3.57	3.68	3.48	3.69
Percentage	77.78	79.17	61.11	72.22	30.56	73.61
Attainment	68.39	67.54	71.36	73.65	69.55	73.77
Actual Attainment	53.19	53.47	43.61	53.19	21.25	54.3
Average = Total score by x number of students attempted this question out of total "n" students / x number of students attempted this question out of total "n" students						
Percentage = Percentage of students attempted this question						
% Attainment = (Average / Max Marks) for each question by attempted students						
Act Attainment = Actual Attainment (Considering all the students)						
Final PO Attainment						
PO5	PO6	PO7	PO8	PO9	PO10	PO12
42	63.33	63.33	63.33	63.33	42	31.6
Final CLO Attainment	CLO 1	CLO 2	CLO 3	CLO 4		
	69.1	71.6	-	73.77		

CIE 2 Question Paper OBE ANALYSIS		
Course Name : EVS (Audit course) Department : Humanities		
Course Code : HS006 Max Marks : 30		
Question	1	2
Blooms Level	L2	L2
CLO	CLO 3	CLO 2
Max Marks	15	15
4MC14CS007	10	10
4MC15CS024	8	8

4MC17CS409	12	12
4MC17CS410	8	8
Average Marks	10.83	9.89
Percentage	100	100
Attainment	72.22	65.93
Actual Attainment	72.22	65.93
Average = Total score by x number of students attempted this question out of total "n" students / x number of students attempted this question out of total "n" students		
Percentage = Percentage of students attempted this question		
% Attainment = (Average / Max Marks) for each question by attempted students		
Act Attainment = Actual Attainment (Considering all the students)		

Final CLO Attainment	CLO 1	CLO 2	CLO 3	CLO 4
	-	65.93	72.22	-

Indirect attainment: student course end feedback	Level of understanding of adverse effect on society by over consumption of resources.	Understand the need to apply sustainable individual practices by self reflection.	Ability to write and present any topic of environmental concern.	understand the need to apply environmental sustainable practices in professional life
1	4	4	4	4
2	5	4	4	4

3	3	4	4	4

49	3	4	4	4
50	5	5	4	5
Students Given > 60%	42	46	46	48
%	84	92	92	96
Co-Relation				
	3	3	3	3

Overall Co Attainment

Direct Attainment					Indirect	
CO	CIE1	CIE2	TOTAL	AVG	CO	
CO1	1		1	1	CO1	3
CO2	2	1	3	1.5	CO2	3
CO3		2	2	2	CO3	3
CO4	2		2	2	CO4	3
				1.62		3
WEIGHT				80%		20%
				1.3		0.6
COA				1.9		
Overall Co Attainment = 1.9 (63.33%)						

CIE 1 Question Paper Map

Question No	Course Outcomes	Level	Program Outcomes
Q1	CLO1	L1	PO6, PO8
Q2	CLO1	L2	PO6, PO8
Q3	CLO1	L2	PO6, PO8
Q4	CLO 2	L1	PO7,PO12
Q5	CLO 2	L2	PO7,PO12
Q6	CLO4	L5	PO8, PO12

CIE 2 Question Paper Map

Question No	Course Outcomes	Level	Program Outcomes
Q1	CLO3	L2	PO5, PO9, PO10
Q2	CLO2	L2	PO7,PO12

HS006: CO-PO MAPPING AND PO ATTAINMENT												
	Program Outcomes											
C Os	1	2	3	4	5	6	7	8	9	10	11	12
CO 1						3		3				
CO2							3					1
CO3					2				3	2		
CO4								3				2
AVG					2	3	3	3	3	2		1.5
COA1.9					1.26	1.9	1.9	1.9	1.9	1.9		0.95
63.33%												
POA					42	63.33	63.33	63.33	63.33	42		31.6

COs are not mapped with PO1-PO4 as specific fundamental engineering skills are not required prerequisite for the course.

CIE 1 CO Attainment					CIE2 CO Attainment			
CLO	CLO1	CLO2	CLO3	CLO 4	CLO1	CLO2	CLO3	CLO4
Attainment	2.07	2.14		2.21		1.97	2.16	
%	69.1	71.6	-	73.8	-	65.93	72.22	-

Final CLO	CLO 1	CLO 2	CLO 3	CLO 4
Attainment	2.07	2.05	2.16	2.21
%	69.1	70.8	72.2	73.8

HS006: FINAL PROGRAM OUTCOME ATTAINMENT

Final PO	PO5	PO6	PO7	PO8	PO9	PO10	PO12
Attainment	1.26	1.9	1.9	1.9	1.9	1.26	0.94
%	42	63.3	63.3	63.3	63.33	42	31.6

4. Observations and Conclusions

The Audit course Environmental Studies aids in broadening of the vision, inculcating attitude, orienting the long reviewed subject matter towards new and well defined horizon. The student is often in the question that having studied this course for many years in school level, why should I undergo it again ? Having the fundamental knowledge of the course, which is ingrained in the student, the course allows for exploration at the conceptual understanding and developing earth thinking attitude. Including the dimension of role and responsibility towards environmental sustainability, societal issues, professional ethics and requirement of life long learning this course enhances the competencies in the students in acquiring the attributes in fulfilling the PO6-12 excluding PO11. This course

1) CO-PO Mapping clearly shows that the audit course environmental studies maps with Program Outcomes PO6-PO12 (excluding PO11).

2) Limitation of mapping of core courses with Program Outcomes PO6-PO12 (excluding PO11) can be overcome.
3) Holistic approach can be adopted in the audit course in acquiring graduate attributes by the student.
4) Course can be modified to include skills and attitude required for application in the final year of the program.
5) Lifelong practice of learning by experiential learning can be integrated in the course.

References

[1] Self Assessment Report (sar) Format undergraduate engineering programs (tier-i) www.nbaind.org/Files/ug-sar-tier-i-final-ver-1.0.pdf
[2] Academic audit - Wikipedia en.wikipedia.org/wiki/Academic_audit