ANALYSIS OF COURSE OUTCOME ATTAINMENT FOR ENGINEERING GRADUATES FOR NBA ACCREDITATION

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Abstract—**The method for finding out the course outcome of a course is very important for the NBA accreditation process. In this paper we have described a method of analyzing the outcomes attained by a student at the end of course delivery. Attainment of Course outcomes are very important as the two important stake holders are the faculty and students. It shows how well the course was delivered and how much it benefitted the students. A good attainment of the Course Outcome in turn leads to good Program Outcome Attainment.**

Keywords—Course Outcomes, National Board of Accreditation (NBA), Program Outcomes

I. INTRODUCTION

With reference to the manual for Self Assessment Report (SAR)[1], considerable importance is given to the calculation of the Course Outcomes of a Program. In our paper we have given a simple and efficient way to calculate the Course Outcomes of a Program. We begin by defining the Course Outcomes of each course under the Program [2]. Then we define a procedure for the calculation of Course Outcome of a course by using internal evaluation methods. The Course Outcome is also calculated using the marks obtained by the student in the semester end external examination usually conducted by the University. The final Course Outcome is calculated by giving 80% weightage to the external examination marks and 20% weightage to the internal evaluation marks. The percentage of weightage given can be decided by the Institution. Also the level of Attainment achieved is based on a scale decided by the Institution.

The paper is arranged in three sections. Section 1 deals with introduction to our project. In section 2 description and methodology of the proposed system is explained. Section 3

concludes the paper by discussing the benefits of monitoring the course outcomes over a period of 2-3 years. The performance of individual students can also be monitored.

II. METHODOLOGY AND DESCRIPTION

The abbreviation used for defining Course Outcomes is as follows. CO101 refers to Course Outcome of the first course in first year of study. CO refers to Course Outcome, 1 refers to first year and 01 refers to the first subject in the first year syllabus. If the particular course has say six course outcomes then it is stated as CO101.1, CO101.2 etc.

A. Internal evaluation of Course Outcomes

The Course Outcome of the course is defined [2] and the methods for assessing the course outcomes by internal evaluation can be done by conducting examinations. The questions asked in the test should be designed to check the attainment of CO's of the course. For example if the total mark for a test is 30 and if 10 marks contribute to CO101.1, 10 matks contribute to CO101.2 and the last 10 marks contribute to CO101.3, the marks should be tabulated under the corresponding course outcomes. Table 2 shows the Tabulation of marks of the internal examinations conducted and tabulated under the three course outcomes of course CO101. The marks obtained by students are classified as weak, Needs Improvement (low), Can do better (medium), Exceeds 1expectation (high). Table 1 shows the classification levels and the weights assigned for each class. An example of Course Outcome for the Course Digital Signal Processing is given below

Upon completion of the course, the students will be able to:

CO101.1 Analyse basic waveforms and perform general operations in linear time invariant systems

CO101.2   Implement various transforms and apply the same in signal processing applications.

CO101.3   Design filters and gain comprehensive knowledge on analog and digital filters

Table 1 shows the classification levels in a scale of 1 and 9, assigned for each class.

The classification levels are defined by the institution. Table 2 shows the Tabulation of marks of the internal examinations conducted and tabulated under the three course outcomes of course CO101.

The scale used for comparison and the range of marks selected for each class is decided by the Institution. The weightage for external evaluation is also decided by the Institution.

TABLE :1 SCALE AND CLASS ASSIGNED

Marks out of 100	Scale of One (normalized)	Scale of Nine	Class	Weightage for External evaluation
Less than 45	Less than 0.45	Less than 4.05	Needs Improvement	1
From 45 to 59	From .45 to 0.59	From 4.05-5.31	Can do Better	3
From 60 to 75	From 0.6 to 0.75	From 5.4-6.75	Satisfactory	6
Greater than 75	Greater than 0.75	Greater than 6.75	Exceeds Expectation	9

TABLE:2 MARKS OF INTERNAL EXAMINATIONS TABULATED UNDER THE COURSE OUTCOMES OF CO101

A	B	C	D	E	F	G	H	I	J	K	L
A	48	60	74	0.48	0.6	0.74	4.32	5.4	6.66	5.46	0.61
B	66	82	84	0.66	0.82	0.84	5.94	7.38	7.56	6.96	0.77
C	62	72	80	0.62	0.72	0.8	5.58	6.48	7.2	6.42	0.71
D	58	68	74	0.58	0.68	0.74	5.22	6.12	6.66	6	0.67
E	76	86	84	0.76	0.86	0.84	6.84	7.74	7.56	7.38	0.82
F	80	58	82	0.8	0.58	0.82	7.2	5.22	7.38	6.6	0.73
G	58	66	74	0.58	0.66	0.74	5.22	5.94	6.66	5.94	0.66
H	64	88	86	0.64	0.88	0.86	5.76	7.92	7.74	7.14	0.79
I	40	90	80	0.4	0.9	0.8	3.6	8.1	7.2	6.3	0.70
J	8	56	70	0.08	0.56	0.7	0.72	5.04	6.3	4.02	0.45
Average of batch of students for CO101=										6.3	.7

Abbreviations in the table are as given below;
- A- Name of Student
- B- Evaluation marks scored by the students for questions that satisfy CO101.1 in the internal examinations (out of 100 marks)
- C- Evaluation marks scored by the students for questions that satisfy CO101.2 in the internal examinations (out of 100 marks)
- D- Evaluation marks scored by the students for questions that satisfy CO101.3 in the internal examinations (out of 100 marks)
- E- Normalised value for CO101.1
- F- Normalised value for CO101.2
- G- Normalised value for CO101.2
- H- Value for CO101.1 in a scale of 9
- I- Value for CO101.2 in a scale of 9
- J- Value for CO101.3 in a scale of 9
- K- Average value for CO101 in a scale of 9
- L- Normalised value for CO101(scale of 1)

The marks are normalized to a scale of one so that it can be easily converted to the scale as defined by the institution. For example, if the scale defined by the institution is 9, the average value of the individual CO's i.e. CO101.1, CO101.2 and CO101.3 and the total value of CO101 can be easily converted to a scale of nine or any scale fixed by the

institution simply by multiplying by the scale fixesd by the institution. As the average value of CO101 is 0.7 the value in a scale of nine is 6.3. Table 3 shows the attainment level of the CO's in a scale of nine.

TABLE 3: CLASSIFICATION VALUES OF COURSE OUTCOMES AND LEVEL OF CO ATTAINMENT CALCULATION

Normalised	Scale of 9	Classification	Attainment
Less than 0.45	Less than 4.05	Needs Improvement	Not Attained
From .45 to 0.59	From 4.05-5.31	Can do Better	
From 0.6-0.75	From 5.4-6.75	Satisfactory	Level of minimum attainment set at 5.4 (.6 normalised)
Greater than 0 .75	Greater than 6.75	Exceeds Expectation	Attained

Table 4 shows the students classified based on their internal marks.

TABLE 4: CLASSIFICATION OF STUDENTS FOR INTERNAL EVALUATION

Classification	Number of Students in each Class
Needs Improvement	0
Can do better	1
Satisfactory	5
Exceeds Expectation	4

TABLE 5: CLASSIFICATION OF EACH STUDENT FOR INTERNAL EVALUATION

Student Name	Internal Marks out of a scale of 9	Classification
a	5.46	Satisfactory
b	6.96	Exceeds Expectation
c	6.42	Satisfactory
d	6	Satisfactory
e	7.38	Exceeds Expectation
f	6.6	Exceeds Expectation
g	5.94	Satisfactory
h	7.14	Exceeds Expectation
i	6.3	Satisfactory
j	4.02	Can do better

The Figure (1) shows the graphical representation of the internal attainment of CO101.
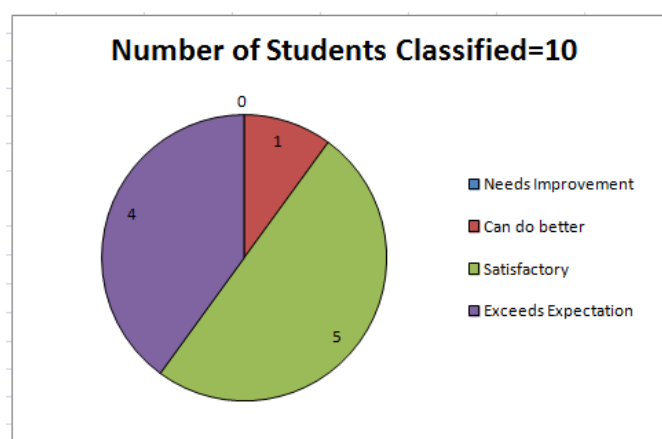

Fig 1: Graphical representation of internal of CO101 classification

The final Course Outcome value is obtained by combining the weighted sum of the internal evaluation marks and the marks obtained in the semester end examination conducted by the university, both converted to the measurement scale as defined by the institution. Table 6 shows the external marks obtained by the students for the course CO101 converted to a scale of 9.

TABLE 6: EXTERNAL MARKS OBTAINED BY THE STUDENTS FOR THE COURSE CO101 CONVERTED TO A SCALE OF 9

Name of student	External Exam Evaluation marks out of 100 or grades for CO101	Weight age for external evaluation
a	40	1
b	70	6

c	80	9
d	70	6
e	90	9
f	92	9
g	64	6
h	75	6
i	35	1
j	30	1

Table 7 shows the Course Outcome Obtained for CO101 by combining the attainments in internal and external evaluation.

The marks are combined by giving 80% weightage to the marks scored in the external evaluation and 20% weightage to the marks scored in the internal examinations. The percentage of the split also can be decided by the institution.

The average value gives the attainment for CO101 for a batch of students. The average gives a value of 6.3 as shown in Table 7. This gives the attainment value for the batch of 10 students for the course outcome of the course CO101 in a scale of nine.

TABLE 7: CO 101 ATTAINMENT VALUE

Name of student	80% weightage for external evaluation	20% weightage for Internal Evaluation	Attainment level for CO101 out of a scale of 9
a	.8	1	1.8
b	4.8	1.6	6.4
c	7.2	1.4	8.6
d	4.8	1	5.8
e	7.2	1.8	9
f	7.2	1.4	8.6
g	4.8	1	5.8
h	4.8	1.6	6.4
i	.8	1.2	2
j	.8	0.6	1.4
		Average=	5.58

Table 8 gives the final course outcomes of 5 different courses in the first year.

TABLE 8: VALUES OF COURSE OUTCOMES IN A SCALE OF NINE

Course number	Conversion to scale of 9 (CAY)
CO101	5.58
CO102	5.4
CO103	3.6
CO104	2.7
CO105	4.5

Table 9 gives the continous monitoring of the CO's of different courses over the last 3 years.

TABLE 9: CONTINUOUS MONITORING OF COURSE OUTCOMES OF DIFFERENT COURSES

Course number	CAY	CAYm1	CAYm2
CO101	5.5	6.1	5
CO102	5.4	6.2	6.2
CO103	3.6	5.2	6
CO104	2.7	4	3.2
CO105	4.5	6	4.1
CO106	7.6	9	6

Figure (2) shows the graph for attainment levels of the courses during the last three years.
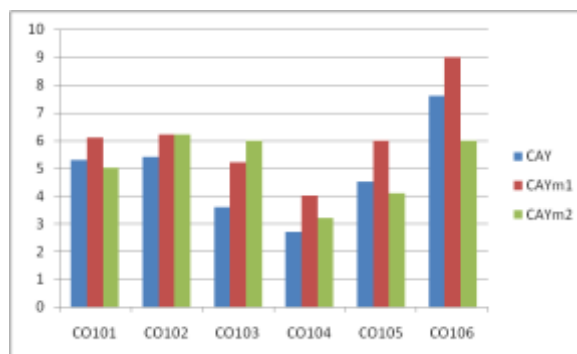

Fig 2: Attainment levels of the courses during the last three years

If the attainment level was set at 5.5 for the course CO101, then in the current academic year CO101 has not reached the required attainment value. Whereas if the attainment level for CO106 was fixed at 7.5 based on past statistics, it can be seen that CO106 has accomplished the stated attainment level.

III.   CONCLUSIONS

The attainment level need not be the same for each course out of a scale of nine. The minimum attainment level for all the courses has to be fixed by the Institution. Above the minimum level, the attainment level for each course has to be fixed based on the statistics of the attainments achieved over the past three years. Continuous improvement of the course can be monitored by tabulating the attainment levels achieved over the years. Table 9 shows the attainment values tabulated for the CAY (current academic year), CAYm1(current academic year minus 1, CAYm2 (current academic year minus 2).

REFERENCES

[1] Manual for Self Assessment Report (SAR) for undergraduate Engineeing Programs (Tier II), First time Accreditation (Applicable for all the programs, except those granted full accreditation for 5 years as per Jan 2013 Manual)

[2] Therese Yamuna Mahesh, Dr. K.L. Shunmuganathan, "Analysis of Program Outcomes Attainment for Engineering Graduates for NBA Accreditation ", Volume 1 Issue 2, MAT Journals, Journal of Information Technology and Sciences 2015.