Implementation of Outcome Based Education Computation of CO-PO Attainment

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Overview

- Attainment of Course Outcomes
 - Oirect attainment of COs is obtained from marks obtained by students.
 - Indirect attainment of COs is obtained from a survey response by students at the end of the semester.
 - Final attainment of COs is obtained using

$$0.7*(CO Direct) + 0.3*(CO Indirect)$$

- Attainment of Program Outcomes
 - 1 Direct attainment of POs is obtained from CO attainment
 - Indirect attainment of POs is obtained from various surveys.
 - Final attainment of POs is the average of direct and all indirect.
- Attainment of Program Specific Outcomes is currently obtained from final CO attainment.
- Attainment of Program Educational Objectives is obtained survey of alumni who have graduated within last 03-05 years.

Part-A: CAM and PAM (CO-PO Mapping)



Course Articulation Matrix in syllabus file

Course Outcome

Up	on c	ompletion of the course, the students will demonstrate the ability to:
CC)1	Compute load flow solution by using different techniques
CC)2	Assess the stability of a power system.
CC)3	Determine the economical load distribution between the generating buses
		incorporating the transmission losses.
CC)4	Compute the state of power system following the different types of faults.
CC)5	Describe automatic generation control schemes and methods to analyze active and
		reactive power control on a power system using simulation tools.

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Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	1	2	1	-	-	-	-	1
CO2	3	3	2	1	1	2	1	-	-	-	-	1
CO3	3	3	2	1	1	2	1	-	-	-	-	1
CO4	3	3	2	1	1	2	1	-	-	-	-	1
CO5	3	3	2	1	1	2	1	-	-	-	-	1

^{1:} Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course	3	3	2	1	1	2	1	-	-	-	-	1



July 2024

Program Articulation Matrix

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BMA2101	3	3	2	2	2	3	P07	PO8	PO9	PO10	2	3
BCH2101	3	3	2	P04	PO5	P06	3	PO8	PO9	2	2	3
BEC2101	3	2	3	3	3	PO6	P07	PO8	PO9	PO10	3	3
BCE2102	3	2	2	2	2	2	3	PO8	2	2	2	3
BCS2102	3	3	3	3	2	PO6	P07	PO8	2	PO10	PO11	3
BCH2191	3	1	2	PO4	2	PO6	3	PO8	2	PO10	2	PO12
BEC2191	3	2	2	3	3	P06	P07	PO8	PO9	PO10	3	3
BCE2192	3	2	2	2	1	3	3	PO8	2	2	2	3
BCS2191	3	3	3	3	2	3	P07	2	3	PO10	PO11	3
BMA2201	3	3	2	2	1	3	3	PO8	PO9	PO10	1	3
BPH2102	3	3	3	2	1	PO6	P07	PO8	PO9	2	PO11	2
BEE2101	3	3	2	3	3	2	3	PO8	PO9	PO10	3	3

- This can be considered to be the relevance of each subject to the program outcomes (average of CO-PO matrix column).
- The above figure is from NBA e-SAR contains only course codes
- The detailed syllabus of the program should contain the PAM whole course in before detailed syllabus are provided.



Part-B Attainment of Course Outcomes





Direct Attainment (Theory Papers)

- Attainment computation by direct methods is from marks obtained by students.
- Student assessment for theory subjects are of two types
 - 1 Formative Assessment (Assignments, Quiz etc)
 - 2 Summative Assessment (Mid Term, End Term exams)
- As per an earlier IQAC decision, VSSUT do not use the formative assessments for computing direct attainment.
- Therefore, the direct assessment of CO attainment is based on Mid Term and End Term marks only.



Should we include assignments etc for direct attainment?

- The logic behind excluding marks of assignment and quiz (as discussed in IQAC meetings) that
 - It will defeat the very purpose of such assignments which are only to build competency in students.
 - 2 It is difficult to segregate CO-wise marks from various assignments and quizzes for all students.
 - 3 The 20 marks also include attendance. It is operationally difficult to calculate the student attendance by segregating classes to COs.
 - If a students has completed the assignments for a particular CO, they must be able to perform well in MT/ET examinations.
 - Thus the MT/ET exams implicitly measure the attainments of assignments.
- The only issue is that excluding the assignments causes the attainment to be a little pessimistic. Since, students are generally given good marks in assignments, it results in a higher numerical value of attainment.
- However, this can be taken care of by deciding the attainment level

Step-1: Enter the Mid Term Marks in sheet 'MT'

В С	D	E	F	G	Н	-1	J	K	L	M	N	0	P	
								Automa	tically Ca	lculated				_
	Course Outcome	CO1	CO2	CO3	COL	CO2	CO3	CO1	CO2	CO3		_		-
	Maximum Marks	2	2	2	8	8	8	10	10	10				_
	Ouestion No	1	-	- 2	2	3	4	10	10	10				_
Regd. No.	Name of the Student	a	b	С		3	*					SUM	Actual Marks	-
1	wante of the Student	2	2	0	6	3	6	8	5	6		19		_
2		2	2	2	5	3	8	7	5	10		22		-
3		2	2	2	8	8	7	10	10	9		29		-
4		0	1	0	5	4	8	5	5	8		18		-
5		2	2	0	6	4	8	8	6	8		22		+
		2	1	0	5	7	8	7	8	8		23		-
6		2	2	0	6	6	7	- 8	8	7		23		-
7		2	2	0	4	6		6	8	4		18		-
8			2	0			4		9			25		_
9		2	1		6	8	8	8		8				_
10		1	2	0	1	8	8	2	10	8		20		
11		2	2	0	7	8	6	9	10	6		25		_
12		2	2	0	8	8	6	10	10	6		26		
13		2	2	0	1	8	5	3	10	5		18		_
14		2	2	0	8	8	8	10	10	8		28		
15		1	2	0	8	6	3	9	8	3		20		
16		2	2	2	8	8	8	10	10	10		30		
17		2	2	0	6	4	8	8	6	8		22		
18		0	2	0	4	6	8	4	8	8		20		
19		0	0	0	4	3	2	4	3	2		9		
20		2	2	0	7	6	8	9	8	8		25		
21		2	2	0	5	8	8	7	10	8		25		
22		2	2	0	8	8	6	10	10	6		26		
23		2	2	0	6	7	8	8	9	8		25	25	
24		2	2	0	8	6	8	10	8	8		26		

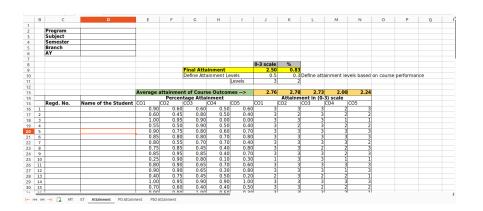
- The yellow background columns are automatically calculated.
- Ensure that the SUM is equal to actual MT marks for each student

Step-2: Enter the End Term Marks in sheet 'ET'

C	D	E	F	G	Н	1	J	K	L	М	N	0	P	Q	R	S	Т	U	V	W
													Thes	e cells are	automati	cally calcu	ulated			
		Course Outcomes	CO1	CO2	CO3	CO4	CO5	CO1	CO2	CO3	CO4	CO5	CO1	CO2	CO3	CO4	CO5			
		Maximum Marks	2	2	2	2	2	8	8	8	8	8	10	10	10	10	10			
		Question No	1					2	3	4	5	6						1		
	Regd. No.	Name of the Student	a	b	С	d	e												SUM	Actual Mark
1			2	2	0	1	2	8	5	6	4	4	10	7	6	5	6		34	34
2			2	1	1	1	1	3	3	5	4	3	5	4	6	5	4		24	24
3			2	2	2	0	0	8	7	7	0	0	10	9	9	0	0		28	28
4			2	1	0	1	0	4	4	10	4	4	6	5	10	5	4		30	30
5			2	2	2	1	2	8	7	6	5	5	10	9	8	6	7		40	40
6			2	2	1	1	2	8	6	7	6	6	10	8	8	7	8		41	41
7			1	1	1	1	0	7	2	6	6	4	8	3	7	7	4		29	29
8			2	2	0	0	2	7	7	5	4	6	9	9	5	4	8		35	35
9			1	2	2	1	2	8	8	7	3	5	9	10	9	4	7		39	39
10	1		1	2	1	1	1	2	6	7	0	2	3	8	8	1	3		23	23
11			1	1	0	1	1	6	7	7	6	5	7	8	7	7	6		35	35
12			2	2	1	0	1	6	6	6	3	7	8	8	7	3	8		34	31
13			1	1	0	1	0	4	4	4	4	2	5	5	4	5	2		21	21
14			2	2	2	1	2	8	7	8	8	8	10	9	10	9	10		48	48
15			1	0	0	0	1	4	4	5	4	4	5	4	5	4	5		23	23
16			1	2	2	1	0	7	6	8	4	3	8	8	10	5	3	1	34	34
17			2	2	0	0	2	7	7	6	4	6	9	9	6	4	8		36	36
18			2	2	0	0	2	8	6	7	3	6	10	8	7	3	8		36	36
19			1	0	0	0	2	6	3	5	2	2	7	3	5	2	4		21	21
20	1		0	1	0	0	1	4	4	7	1	5	4	5	7	1	6		23	23
21			1	2	0	0	0	7	6	7	0	6	8	8	7	0	6		29	29
22			1	2	1	0	1	4	4	6	0	7	5	6	7	0	8		26	26
23			1	2	0	0	0	6	5	5	5	0	7	7	5	5	0		24	24
24	1		0	1	0	1	1	8	5	6	4	5	8	6	6	5	6	1	31	31

- The yellow background columns are automatically calculated.
- Ensure that the SUM is equal to actual ET marks for each student

Step-3: Define attainment levels



- Copy student registration number and name from Mark Foils.
- Define attainment levels in cells J10, K10.
- Attainment levels should be ratified by BoS of the semester.



Final CO Attainment

D10		∨ f x	Σ - =	=0.7*B10+0.3	*C10	
	Α	В	С	D	Е	
1						
2		STEP-1	The Direct	t Attainmer	t of CO is a	U
3		STEP-2	Enter the	Indirect Att	ainment of	C
4		STEP-3	Change t	he CO-PO m	apping refe	15
5		STEP-4	Change t	he Program	Articulation	
6		STEP-5	If there is	no mappin	g, 0 should	1
7						
8					PO Attainment	
9		Direct	Indirect	Final CO		Ŀ
10		2.50	2.91	2.63	CAM Row	
11						0

Indirect Attainment of Course Outcomes

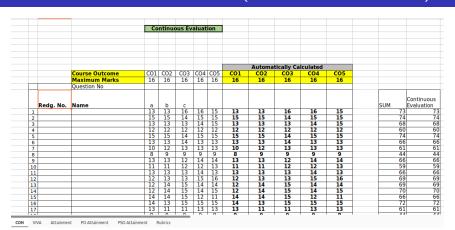
- In the previous slide 2.50 is the direct attainment.
- The value 2.91 is obtained from **Indirect Attainment of Course Outcomes** by taking a survey from all students of the course.
- A format for indirect attainment of course outcomes is provided in the IQAC website (Please refer the next slide).
- Subject teachers should share the form with the students at the end of the semester and obtain average values of responses for each COs.
- The student should write (0/1/2/3) under the COs based on what he feels about his competency in the respective CO.
- Finally the average of CO1 column is the indirect attainment of CO1. Similar for other CO2, CO3, CO4 and CO5.
- The final value of indirect attainment of CO for the particular subjection is = Average of CO1, CO2, CO3, CO4, CO5.

Format for Indirect Attainment of COs

SL. NO.	Regd. No.	CO1	CO2	CO3	CO4	CO5	Remarks
14	2102050016						
15	2102050017						
16	2102050018						
17	2102050019						
18	2102050020						
19	2102050021						
20	2102050024						
21	2102050026						
22	2102050027						
23	2102050028						
24	2102050029						
25	2102050030						
26	2102050031						
27	2102050032						
28	2102050033						
29	2102050034						
30	2102050035						
31	2102050036						
32	2203050001						
33	2203050002						
34	2203050003						
35	2203050004						
36	2202050005						



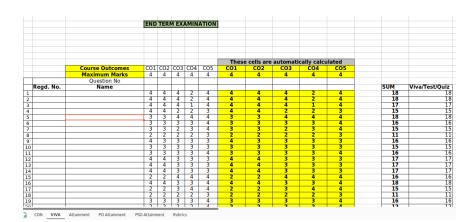
Direct CO Attainment for Lab (Continuous Evaluation)



- Continuous evaluation is of 80 marks.
- Each CO should ideally be assigned 16 marks.
- Students should be evaluated for each experiment.
- A CO can span multiple experiments.



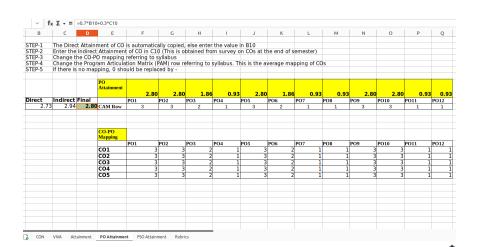
Direct CO Attainment for Lab (End Evaluation)



- End evaluation is of 20 marks (Test/Viva/Quiz).
- Each CO should ideally be assigned 4 marks.
- Students should be evaluated for each CO.



Final CO Attainment for Lab



- Final CO attainment = 0.7 * Direct + 0.3 * Indirect.
- Indirect attainment is by survey similar to theory subjects.



Part-C Attainment of Program Outcomes





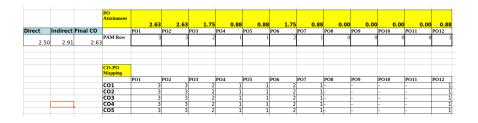
PO Attainment Method-1

- As per the NBA portal requirements, the PO attainment for each subject is required to be uploaded.
- In the excel formats PO attainment is computed using the formula

Final CO Attaiment
$$\times \frac{\text{Average Mapping for that PO}}{3}$$
 (1)

- Please refer the next slide for detailed formula.
- Problems with this approach
 - Any CO-PO mapping which is less than 1 or 2 will results in lower PO attainment even if the CO attainment is very high.
 - This method implicitly discourages actual CO-PO mapping.
 - O attainment ideally should be of a particular batch and not for a particular subject.
- The NBA portal averages the PO attainment of each subject to the final PO attainment. Hence, 1/2 mapping lowers the attainment.

PO Attainment Method-1 (cont.)



- The final CO value to be used (NOT direct/indirect)
- When there is no mapping, keep it blank in the NBA portal.
- \bullet Note the lower value of PO attainment when the mapping is <3.



Method-2

- This method was originally planned to be used in VSSUT in 2019.
- This provides the direct attainment of POs batchwise.
- For example, consider the graduating batch of 2023.
 - For first year, the CO attainment of 2019-20 to be used.
 - ② For second year, the CO attainment of 2020-21 to be used.
 - 3 For third year, the CO attainment of 2021-22 to be used.
 - 4 For final year, the CO attainment of 2022-23 to be used.
- Working formula (Detailed excel format uploaded in website).

Final CO
$$\times$$
 $\frac{\text{CO-PO mapping for that subject only}}{\text{Sum of mapping for all subjects for that PO}}$ (2)

- Please refer the next slide for details.
- The disadvantages of this method is that the individual contribution of subjects for final PO is not in 1-3 scale.
- However, PO attainment obtained using this method must be avain file, because this seems to be the accurate way.

PO Attainment Method-2 (cont.)

E	F	G	Н	1	J	K	L	М	N	0	P	Q	R
		2.524	2.514	2.513	2.534	2.588	2.541	2.535	2.597	2.645	2.621	2.577	2.548
Code	Final CO	PO1	PO2	PO3	PO4	PO5	P06	PO7	PO8	PO9	PO10	PO11	PO12
3MA2101	2.31	0.041	0.048	0.057	0.053	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.038
3PH2101	2.41	0.042	0.051	0.059	0.056	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.040
BEE2101	2.12	0.037	0.030	0.017	0.049	0.022	0.038	0.067	0.108	0.047	0.095	0.053	0.052
BCS2101	2.56	0.045	0.054	0.063	0.039	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.042
BCE2101	2.83	0.033	0.020	0.023	0.044	0.000	0.152	0.135	0.048	0.031	0.042	0.071	0.070
BPH2191	2.73	0.016	0.019	0.022	0.042	0.028	0.000	0.000	0.046	0.090	0.041	0.034	0.022
BEE2191	2.82	0.049	0.059	0.023	0.022	0.058	0.101	0.134	0.143	0.062	0.084	0.071	0.069
BME2191	2.72	0.016	0.019	0.022	0.042	0.083	0.000	0.000	0.046	0.090	0.041	0.034	0.022
BCS2191	2.81	0.016	0.020	0.023	0.043	0.057	0.000	0.000	0.048	0.093	0.042	0.035	0.023
BMA2201	2.43	0.043	0.051	0.060	0.056	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.040
BCH2101	2.14	0.038	0.045	0.053	0.049	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.035
BEC2101	2.59	0.045	0.036	0.021	0.060	0.026	0.046	0.082	0.132	0.057	0.116	0.065	0.064
BCS2101	2.37	0.042	0.033	0.019	0.055	0.024	0.042	0.075	0.121	0.052	0.106	0.059	0.058
BHU2101	2.67	0.000	0.000	0.000	0.000	0.027	0.048	0.085	0.045	0.029	0.120	0.100	0.066
BCH2191	2.75	0.016	0.019	0.023	0.042	0.028	0.000	0.000	0.047	0.091	0.041	0.034	0.023
BEC2191	2.81	0.049	0.059	0.023	0.022	0.057	0.100	0.134	0.143	0.062	0.084	0.070	0.069
BCE2191	2.86	0.033	0.040	0.047	0.044	0.029	0.000	0.000	0.048	0.094	0.128	0.036	0.023
BHU2191	2.93	0.000	0.000	0.000	0.000	0.030	0.052	0.093	0.050	0.032	0.131	0.110	0.072
BMA1301	2.27	0.040	0.048	0.056	0.052	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.037
BEE1302	2.26	0.040	0.032	0.019	0.000	0.046	0.040	0.000	0.000	0.025	0.000	0.000	0.037
BEE1303	2.16	0.038	0.045	0.018	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.035
BME1303	2.18	0.038	0.046	0.054	0.050	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.036
BHU2302	2.06	0.012	0.014	0.017	0.016	0.021	0.074	0.098	0.070	0.045	0.061	0.077	0.017
BEE1392	2.91	0.051	0.020	0.024	0.067	0.059	0.000	0.000	0.000	0.064	0.043	0.036	0.024

PO Attainment (Indirect)

- The indirect assessment of PO attainment is obtained using Surveys.
- In 2019 Curriculum workshop, it was decided to use only the above three surveys for indirect assessment of PO attainment.
 - Student Exit Survey
 - 2 Employer Survey
 - Alumni Survey
- Student Exit Survey is collected by IQAC during the month of May after the final exams and over, but result is not out.
- **Employer Survey** is conducted by Training & Placement department both online and offline every academic year.
- **Alumni Survey** is conducted by departments from various Alumni meets and events or by direct contact with alumni.

Final PO Attainment

Method	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Direct	2.52	2.51	2.51	2.53	2.59	2.54	2.53	2.60	2.65	2.62	2.58	2.5
Exit Survey	2.71	2.87	2.65	2.91	2.74	2.35	2.87	2.33	2.73	2.78	2.46	2.76
Alumni Survey	2.57	2.69	2.14	2.67	2.84	2.94	2.87	2.39	2.54	2.56	2.87	2.3
Employer Survey	2.47	2.54	2.68	2.57	2.64	2.78	2.43	2.62	2.67	2.39	2.76	2.4
Final Attainment	2.57	2.65	2.50	2.67	2.70	2.65	2.68	2.48	2.65	2.59	2.67	2.5
Final Attainment (%)	85.62	88.45	83.19	89.03	90.07	88.43	89.21	82.81	88.21	86.26	88.89	83.5

- Please note that the averaging is done by the NBA portal.
- We need to enter the summary of various surveys only.
- The direct attainment is average of all subjects.
- Please ensure that the values available in NBA files match with the attainment levels in the NBA portal.



Course File

- The document Course File contains the detailed steps of the Course Planning, Delivery and Evaluation.
- Group-1 (Course Planning)
 - Vision and Mission (Institute and Department)
 - Program Educational Objectives (PEOs)
 - 3 PEO-Mission Mapping (Mission of Dept.)
 - Program Outcomes (PO); Program Specific Outcomes (PSOs)
 - 5 Detailed Curriculum and Course Outcomes (COs)
 - Ourse Articulation Matrix (CO-PO mapping);
 - Program Articulation Matrix (Subject-PO mapping).
- Group-2 (Course Delivery)
 - Class Time Table
 - Attendance Sheets
 - 4 Lesson Plan
 - Class Diary
 - Assignment Questions
 - Quiz Questions



Course File (Cont.)

- Group-3 (Evaluation)
 - Rubrics for this course
 - Sample Assignments/Lab records
 - Survey responses for Indirect Assessment of COs
 - 4 Print of 'Attainment' sheet of CO evaluation excel.
 - Print of Gradesheets
 - Result Analysis
- Ideally, a every unique subject should have a unique course file.
- Since there is a risk of documents being lost. Therefore, VSSUT maintains Course Files by the Instructors.
- Course files for Project-I, Project-II, Seminar etc should be maintained at program/department level with detailed Rubrics.
- Course Files for Laboratory, ideally, should be available in the concerns
 labs organized by the Lab-in-charge and Instructor-in-charge.

A case for Automation

- Provision can be made for submitting Course outcome attainments (direct and indirect) along with semester marks.
- Program Articulation Matrix (Subject-PO mapping OR the average of CO-PO mapping) should be part of the software.
- Using the PAM, subject wise PO attainment is obtained at the time of publication of results.



Thank You

