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Training program in School of Engineering on direct CO-PO attainment (October 26, 2022)

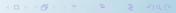
Presentation plan

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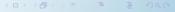
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- Introduction to OBE system



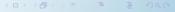
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- Introduction to OBE system
- Design and evaluation of attainment of COs



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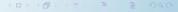
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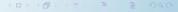
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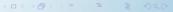
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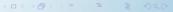
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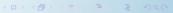


- ► Traditional education system is mostly input-oriented
 - It gives more emphasis on the availability of input resources
 - It puts little or no concern to the quality of output
 - Its teaching-learning process suggests to work hard mainly to complete the syllabus so as to score good marks in examinations
 - Thus, it compromises with the need of acquiring enough knowledge or skill to become employable or self-professional in some form
- ► Hence, the present emphasis all around the world is put on the measurable Outcome-Based Education (OBE)
 - It targets to allow students to customize a Program as per their own choices, so as to achieve certain desirable outcomes related to the acquiring of knowledge, skills, attitudes and behavior under the guidance from teachers, instructors and mentors



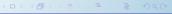
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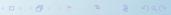


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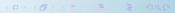
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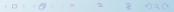
Introduction to PFO

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Introduction to PFO

- ▶ OBE system involves a continuous methodology for ascertaining the achievement of the desired outcomes, which are usually benchmarked as the Program Educational Objectives (PEOs)

PO attainment



Introduction to PFO

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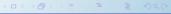
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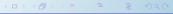
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- ▶ PEOs are targeted to be achieved through the attainment of a set of Program Outcomes (POs) in the form of just like vision and mission, respectively
 - POs are narrow statements that describe what students upon graduating from the Program are expected to learn in terms of knowledge, skills, attitudes, and behavior [3]
- Attainment of POs of a Program are materialized through the attainment of the Course Outcomes (COs) of the Courses of the Program
 - COs are narrower statements that describe what students upon completing a Course are expected to learn in terms of knowledge, skills, attitudes, and behavior [3]
- Accordingly, OBE-PEO-PO-CO becomes the hierarchy tree of the modern education system
 - ▶ It allows Institutes themselves to assess and evaluate the objectives and outcomes of their Programs and make necessary modifications accordingly, in the form of finding and bridging gaps, for attaining the targeted objectives and outcomes

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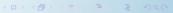
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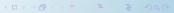
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Difference between traditional and OBE systems



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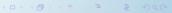
- ► The traditional input-based education system works as follows:
 - Job of teachers is just to complete the teaching as a one-way process
 - It leaves the learning as well as the building of professional careers of students solely upon the students themselves
- Scenario in the OBE system is quite different
 - ▶ Job of teachers is not only to teach the curricula as a one-way process
 - But also to design and implement an effective teaching-learning process
 - To ensure the learning of students
 - Also to meet their own promises made in the forms of COs, POs and PEOs



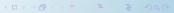
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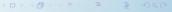
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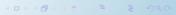
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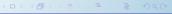
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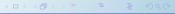
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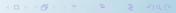


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- sets broad guidelines for assessing and evaluating the attainment of COs and POs

- ► Formal recognition of the attainment of objectives and outcomes of a Program can be obtained through its accreditation by an independent external agency
 - Accreditation is a process of quality assurance and improvement
 - It assesses a Program impartially and critically to verify that the Program continuously meets the assessment criteria prescribed by the accrediting agency
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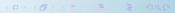
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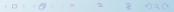
- ▶ Design and evaluation of CO attainment involve a series of jobs
 - Defining some expected COs for a Course
 - Preparing lesson plan for effective teaching and learning
 - Setting question paper with CO-wise questions
 - Moderating question paper for correctness and appropriateness
 - Evaluating answer scripts in a particular style to facilitate the evaluation of CO attainment
 - ▶ Then, evaluating the attainment of COs of the Course



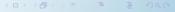
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- ▶ Some COs for each Course can be set based on the expected learning by students on completion of the study of a Course, e.g.,
 - Ability to recognize the physical phenomena of the contents of the Course
 - ► To demonstrate the understanding of the theories and their limitations covered in the Course
 - ► To identify and solve industrial and real life problems by applying the studied theories etc.
- ▶ Different assessment tools can be used for evaluating the attainment of the COs of a Course by measuring the learning of students from the Course, such as:
 - ▶ Performances of students in Examinations, Sessional Tests, Seminars, Project works, Field works, etc.
- ► Number of COs of a Course may usually be 3–6, but it may be fixed as per the requirement of an accrediting body or any other concerned authority, e.g.,

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- ► Some COs for each Course can be set based on the expected learning by students on completion of the study of a Course, e.g.,
 - Ability to recognize the physical phenomena of the contents of the Course
 - To demonstrate the understanding of the theories and their limitations covered in the Course
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 - Performances of students in Examinations, Sessional Tests, Seminars, Project works, Field works, etc.
- ► Number of COs of a Course may usually be 3–6, but it may be fixed as per the requirement of an accrediting body or any other concerned authority, e.g., NBA [4, 5] expects around 6 COs per Course

Preparation of Course lesson plan

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► For a transparent and recorded process of teaching as well as for enabling students to know how the teaching will progress, a detail lesson plan of each Course should be prepared and distributed among students prior to starting the teaching

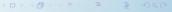


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Unit	Title	Contents	CSU	CO	L-T-P
	Introduction	Definition of	1	1	
1		Significance of	2	3	4-1-0
		Application of	3	2	
2			4	1,2	6-2-2
			5	4	0-2-2
6			17	3	3-1-1
			18	2	
Total					35-10-6

CO attainment 0000000000000000

Question paper setting

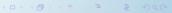


Question paper setting

Plan

► In order to ease the evaluation of CO attainment of a Course, its question papers may be set as per its COs, making sub-questions under a CO, if required

- ▶ Sub-questions, e.g., 1(a) and 1(b) above, may be from different Units also, but must be from the same CO
- In order to avoid the dropping of coverage of any CO from the question paper, optional questions, if any, should be made only in sub-questions of equal marks, e.g., answer Q.1(a) or Q.1(b) in the above example (instead of, answer Q.1 or Q.2)



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CO	Sub Content of question		CSU	BTL	Marks	Total
1	(a) Define		3	2	2	5
_	(b) Express		4	3	3	3
2	2 Explain what does				7	7
5	5 Apply the formula of				10	10
	Grand total 1					

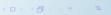
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Question paper setting (Contd...)

- Question-wise CSUs may also be shown in order to depict the setting of the question paper by covering the contents of the Course to the maximum extent

PO attainment

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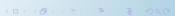


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As per BTL, questions can be numbered according to their levels of difficulties

BTL	Meaning	Attainment
6	Creating	Generating new ideas or products for viewing things differently
5	Evaluating	Justifying a decision or situation
4	Analyzing	Exploring understanding by breaking information into pieces
3	Applying	Using information of a situation in another similar situation
2	Understanding	Explaining ideas or concepts
1	Remembering	Recalling previously learned material from memory



Question paper moderation

 Moderation of a question paper by a subject-expert is an integral part of the question paper setting in order to crosscheck its correctness and appropriateness



Question paper moderation

Plan

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Question paper moderation

Moderation of a question paper by a subject-expert is an integral part of the question paper setting in order to crosscheck its correctness and appropriateness

1.	Whether the question paper is set CO, CSU and BTL wise?	: Yes/No
	Comments of Moderator:	. Tes/110
2.	Does the question paper meet the standard of the level of students?	: Yes/No
	Comments of Moderator:	. res/ No
3.	Does the question paper properly cover the syllabus specified for this examination?	: Yes/No
	Comments of Moderator:	: res/ No
4.	Whether the question paper is technically accurate?	: Yes/No
	Comments of Moderator:	. res/ No
5.	Whether the question paper is edited/ formatted accurately?	: Yes/No
	Comments of Moderator:	. res/ NO
6.	Whether the question paper is linguistically accurate?	: Yes/No
	Comments of Moderator:	. 165/110
7.	Whether any question is verbatim copy from any of the question papers of the	: Yes/No
	Course of last two years?	. 165/ NO
	C + CM + +	_

CO attainment 0000000000000000

Answer-script evaluation

► As the setting of question papers CO-wise in order to ease the evaluation of CO attainment, answer-scripts of students may also be evaluated CO-wise



Apart from Theory Courses, Practical, Project, Seminar, or any other Course of that nature will also have some COs. Hence, such a Course may also be evaluated as above

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CO	a	b	С	d	e	f	g	h	i	j	Total
1											
2											
3											
									Grai	nd total	

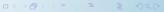
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Letter grade	Description	Grade point
0	Outstanding	10
A+	Excellent	9
A	Very good	8
B+	Good	7
В	Above average	6
С	Average	5
Р	Pass	4
F	Fail	0
Ab	Absent	0

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- ▶ It involves 7 successful completion grades (O, A+, A, B+, B, C and P) and 2 unsuccessful grades (F and Ab) on a 10-point scale
- ► Accordingly, the successful grades of the highest (outstanding), middle (good) and lowest (pass) levels are O, B+ and P, respectively

Evaluation of CO attainment (Contd... 2)

► According to above, a rubric system on a 3-point scale can be devised as follows:



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Performance of overall students on individual COs	Rubric	Rubric
	level	value
50% or above students scored the same minimum percentage of absolute marks on the CO for which B+ grade will be awarded on the Course		3
50% or above students scored the same minimum percentage of absolute marks on the CO for which C grade will be awarded on the Course		2
50% or above students scored the same minimum percentage of absolute marks on the CO for which P grade will be awarded on the Course		1
50% or above students scored the same minimum percentage of absolute marks on the CO for which an unsuccessful grade will be awarded on the Course	Poor	0

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 - ► In case of Tier-I Institutes, NBA suggests to set rubric levels in terms of percentage of students achieving the minimum targets set for Institute-level assessment tools and the minimum of class average targets for internal assessment tools [4]

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 - ► The same for Tier-II Institutes are suggested numerically as the securing of the minimum of Institute average targets by 60%, 70% and 80% students in Institute-level assessment tools, and the securing of the minimum of 60% targets by 60%, 70% and 80% students in internal assessments tools [5]

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- Notice that there is no attainment in the NBA model if minimum 60% students cannot secure average targets, which might be difficult to achieve in some cases
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- Notice that there is no attainment in the NBA model if minimum 60% students cannot secure average targets, which might be difficult to achieve in some cases
- ▶ Hence, a simplified rubric system is suggested in the present proposal
 - ► There will be some attainment in any assessment tool if a minimum of 50% students can secure the same minimum percentage of absolute marks for which the minimum qualifying letter grade will be awarded to students on the Course

► An example of evaluating the attainment of individual COs is shown below:



Evaluation of CO attainment (Contd... 4)

▶ An example of evaluating the attainment of individual COs is shown below:

Students' Roll No.	Sessional Test I				Sess	siona	I Tes	st II	Mid	l-Sen	n. Ex	cam					
and other detail	CO_1	CO ₂	CO ₃	CO ₄	CO_1	CO ₂	CO ₃	CO	CO ₁	CO ₂	CO ₃	CO ₄	CO_1	CO ₂	CO ₃	CO	
MEB3001	4	4	8	4	8	9	5	_	8	7	9	8	14	14	14	8	
MEB3060																	
Maximum marks	5	5	10	5	5	10	10	_	10	10	10	10	15	15	15	15	
Total No.of students	60	60	60	60	60	60	60	_	60	60	60	60	57	57	57	57	
Lowest % marks by ≥ 50% students	72%	80%	45%	25%	77%	55%	71%	-	75%	70%	65%	43%	73%	59%	52%	79%	
Scored rubric value	3	3	1	0	3	2	3	-	3	3	2	1	3	2	2	3	
(S_{ijk}^*)	S_{i11}	<i>S</i> _{<i>i</i>21}	<i>S</i> _{<i>i</i>31}	S_{i41}	S_{i12}	<i>S</i> _{<i>i</i>22}	<i>S</i> _{i32}	S_{i42}	S_{i13}	<i>S</i> _{<i>i</i>23}	<i>S</i> _{i33}	<i>S</i> _{i43}	<i>S</i> _{<i>i</i>14}	<i>S</i> _{<i>i</i>24}	<i>S</i> _{i34}	S _{i44}	

^{*} S_{ijk} is the attainment of the jth CO of the ith Course in the kth assessment tool

▶ An example of evaluating the attainment of individual COs is shown below:

Students' Roll No.	Sessional Test I															
and other detail	CO_1	CO ₂	CO ₃	CO ₄	CO_1	CO ₂	CO ₃	CO ₄	CO_1	CO ₂	CO ₃	CO ₄	CO_1	CO ₂	CO ₃	CO ₄
MEB3001	4	4	8	4	8	9	5	_	8	7	9	8	14	14	14	8
MEB3060																
Maximum marks	5	5	10	5	5	10	10	_	10	10	10	10	15	15	15	15
Total No.of students	60	60	60	60	60	60	60	_	60	60	60	60	57	57	57	57
Lowest % marks by	72%	80%	45%	25%	77%	55%	71%	_	75%	70%	65%	43%	73%	59%	52%	79%
\geqslant 50% students																
Scored rubric value	3	3	1	0	3	2	3	_	3	3	2	1	3	2	2	3
(S_{ijk}^*)	S_{i11}	S_{i21}	S_{i31}	S_{i41}	S_{i12}	<i>S</i> _{<i>i</i>22}	<i>S</i> _{i32}	S_{i42}	<i>S</i> _{<i>i</i>13}	<i>S</i> _{<i>i</i>23}	S_{i33}	<i>S</i> _{i43}	S _{i14}	S_{i24}	<i>S</i> _{<i>i</i>34}	S _{i44}

^{*} S_{ijk} is the attainment of the jth CO of the ith Course in the kth assessment tool

Note that NBA [4, 5] has not stated anything categorically about how S_{ijk} can be obtained from students' performances in an assessment process

Evaluation of CO attainment (Contd... 5)

After evaluating S_{ijk} as above, finally the overall CO attainment of the *i*th Course in the form of a single percentage value can be evaluated as X_i through Eq. (1)

$$X_i = \left(\frac{1}{R_1 C_i} \sum_{j=1}^{C_i} \mathsf{x}_{ij}\right) \times 100\%$$
 (1a)

where,
$$x_{ij} = \frac{1}{a_{ij}} \sum_{k=1}^{A_i} S_{ijk}$$
 (1b)

or,
$$x_{ij} = \sum_{k=1}^{A_i} w_{ik} S_{ijk}$$
 with $\sum_{k=1}^{A_i} w_{ik} = 1$ (1c)

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Evaluation of CO attainment (Contd... 5)

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 (1b)

or,
$$x_{ij} = \sum_{k=1}^{A_i} w_{ik} S_{ijk}$$
 with $\sum_{k=1}^{A_i} w_{ik} = 1$ (1c)

ln Eq. (1), a_{ii} = total no. of assessment tools by which the jth CO is evaluated, w_{ik} = weightage to the kth assessment tool, x_{ii} = overall attainment of the jth CO, A_i = total no.of assessment tools applied for the Course, C_i = total no.of COs of the Course, and R_1 = scale point of the rubric system.

Evaluation of CO attainment (Contd... 6)

▶ Implementing Eq. (1), the CO attainment is illustrated below:

Note that NBA [4] has not mentioned how x_{ij} should be calculated in Tier-I Institutes, while categorically specified for weighted attainment of CO for Tier-I

▶ Implementing Eq. (1), the CO attainment is illustrated below:

Course:			Rubric value		4 1 1 1 1 1 1			
ME999	Sessional Test Sessional Test		ional Test Sessional Test Mid-Semester E		Average (x_{ij})			
		II .	Exam	Exam				
CO1	3	3	3	3	3			
CO2	3	2	3	2	2.5			
CO3	1	3	2	2	2			
CO4	0	_	1	3	1.33			
				Overall average	2.21			
	CO attainment of the Course, X_i							

Evaluation of CO attainment (Contd... 6)

Plan

Implementing Eq. (1), the CO attainment is illustrated below:

Course:			Rubric value					
ME999	Sessional Test I	ional Test I Sessional Test Mid-Semeste		End-Semester	Average (x_{ij})			
		II	Exam	Exam				
CO1	3	3	3	3	3			
CO2	3	2	3	2	2.5			
CO3	1	3	2	2	2			
CO4	0	_	1	3	1.33			
				Overall average	2.21			
	CO attainment of the Course, X_i							

Note that NBA [4] has not mentioned how x_{ii} should be calculated in Tier-I Institutes, while categorically specified for weighted attainment of CO for Tier-II Institutes [5]

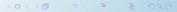


- Introduction to OBE system
- Design and evaluation of attainment of COs
- Design and evaluation of attainment of POs
- Implementation of the CO-PO attainment model
- References

(25/44)

Design and evaluation of attainment of POs

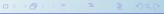
- Design and evaluation of PO attainment involve another series of jobs.
 - Setting some expected POs of the Program (including Program-Specific Outcomes (PSOs) if any) by merging the COs of its Courses
 - Preparing Course-wise CO-PO articulation matrices
 - Evaluating Course-wise attainment of POs
 - Then, evaluating the overall PO attainment of the Program.



(26/44)

Design and evaluation of attainment of POs

Design and evaluation of PO attainment involve another series of jobs



(26/44)

Implementation

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 - Setting some expected POs of the Program (including Program-Specific Outcomes (PSOs), if any) by merging the COs of its Courses



(26/44)

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 - Preparing Course-wise CO-PO articulation matrices

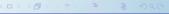
Implementation

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 - Evaluating Course-wise attainment of POs

Design and evaluation of attainment of POs

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 - Setting some expected POs of the Program (including Program-Specific Outcomes) (PSOs), if any) by merging the COs of its Courses
 - Preparing Course-wise CO-PO articulation matrices
 - Evaluating Course-wise attainment of POs
 - ► Then, evaluating the overall PO attainment of the Program



- ► An academic Program, e.g., UG in Mechanical Engineering, comprises a number of Courses for teaching over its entire time duration
- Accordingly, some POs can be set by merging the COs of those Courses, which (i.e., POs) are expected to meet on completion of the study of the Program
- Inversely, it is also possible to set the POs first and then to design some Courses by splitting the POs as their COs in a way that the completion of the Courses by students will mean the meeting of the POs
- ► In both modes for setting COs and POs, the COs of all the Courses of a Program should collectively cover all the POs of the Program
- Number of POs of a Program may usually be 4–12, but like in the case of the number of COs of a Course, it may also be fixed as per the requirement of an accrediting body or any other concerned authority, e.g., NBA [4, 5] has defined fixed and common 12 POs for all UG Engineering Programs

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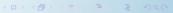
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- ▶ A Program in higher education usually comprises a set of compulsory Courses; as well as some other sets of different types of Elective Courses, e.g., Program Elective I, Program Elective II, Open Elective II, Open Elective II, etc.
- Hence, POs of a Program may be set based on the COs of its commusory Courses (both Credit and non-Credit Courses) only, which is suggested by NDA [4, 5] also
- Reason is very simple and a
 - Usually 2 or more Courses of similar nature are offered under each type of Elective Course, e.g., Computer Programming and Application of Commercial Software Packages are offered under Program Elective I as computation-based Courses
 - ➤ Since the COs of such Elective Courses are likely to be different, some students may miss the attainment of some POs if those are framed by covering the COs of all the offered Elective Courses, while the CO-PO articulation will be biased to some Courses if the POs are framed by covering the COs only of selective Courses

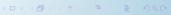


Plan

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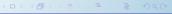
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CO-PO articulation or CO-PO correlation matrix

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Plan

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PO-wise weightage (relation) of CO	Rubric value
Substantial (High)	3
Moderate (Medium)	2
Slight (Low)	1
No correlation	_

CO-PO articulation or CO-PO correlation matrix (Contd...)

► As per above rubric system, the COs of a Course can be correlated to the POs of its Program in the form of a matrix, defined by NBA [4, 5] as the CO-PO articulation matrix or Course articulation matrix



(30/44)

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- ► Such a CO-PO articulation matrix is illustrated below:



(30/44)

Plan

Implementation

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- Such a CO-PO articulation matrix is illustrated below:

Course:	PO-wise weightage of COs (y _{ijm} *)								
ME999	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	
CO1	3	-	_	_	2	_	-	1	
CO2	2	_	1	_	_	_	2	3	
CO3	-	2	_	_	-	3	_	_	
CO4	-	3	_	_	-	_	_	2	

^{*}y_{iim} is the weightage of the jth CO of the ith Course to the mth PO

Evaluation of Course-wise attainment of POs

After evaluating the CO attainment and defining the CO-PO articulation matrix, average attainment of individual POs against a Course can be evaluated by Eq. (2)

$$z_{im} = \frac{1}{R_2 l_{im}} \sum_{i=1}^{C_1} x_{ij} y_{ijm} \tag{2}$$

In Eq. (2), z_{im} = attainment of the mth PO against the ith Course, x_{ij} = average rubric value attained against the jth CO of the ith Course, y_{ijm} = weightage of the jth CO of the ith Course to the mth PO, C_i = total number of COs in the ith Course, l_{im} = total number of COs of the ith Course correlated to the mth PO, and R_0 = scale point of the rubric system used for correlating COs to POs

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Evaluation of Course-wise attainment of POs (Contd...)

▶ Individual PO values attained against the *i*th Course by applying Eq. (2) are illustrated below:

Evaluation of Course-wise attainment of POs (Contd...)

Individual PO values attained against the ith Course by applying Eq. (2) are illustrated below:

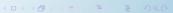
Course:	Attainment of Course-wise individual POs							
ME999	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8
Attainment	2.33	1.33	0.83	-	2.00	2.00	1.67	1.46
of POs, z _{im}	Z _{i1}	Zi2	Zi3	Zi4	Zi5	Zi6	Z _{i7}	Zi8

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Overall PO attainment

Plan

PO attainment



Overall PO attainment

Plan

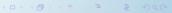
▶ NBA [4, 5] suggests to evaluate PO attainment for a Program by two methods direct and indirect attainment methods

(33/44)

Overall PO attainment

Plan

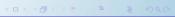
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 - Direct attainment method: It is essentially based on students performances on the compulsory Courses of the Program, which can be evaluated directly by measurable assessment tools, such as examinations, viva-voce, or showcasing knowledge or skill in some other specified forms



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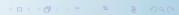
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 - Indirect attainment method: It is based on surveys conducted among graduated students, employers of graduated students, co-curricular and extra-curricular activities of students, etc.
- ▶ After the evaluation by both the methods, the overall PO attainment can be obtained by summing up them with some weightage, e.g., 80% weightage to direct assessment and rest 20% weightage to the indirect assessment

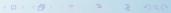


Evaluation of overall PO attainment by direct method

 On completion of the study of a batch of students in a Program, the direct attainment of individual POs of the Program for that particular batch of students can be evaluated by Eq. (3)

$$Z_m = \frac{1}{N} \sum_{i=1}^{N} z_{im} \tag{3}$$

- In Eq. (3), Z_m = direct attainment of the mth PO over the entire Program for a given batch of students, z_{im} = attainment of the mth PO against the ith Course as given by Eq. (2), and N = total number of Courses of the Program to be taken into account in the evaluation of PO attainment
- ▶ If it is not possible to complete the exercise with all the Courses, as suggested by NBA [4, 5], some selective Courses with at least one Course from each Semester, that will collectively cover all the POs, may also be considered for the exercise



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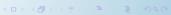
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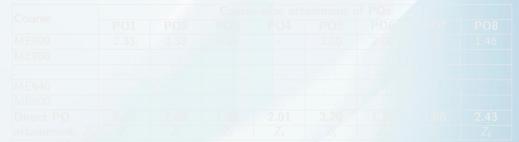
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Evaluation of overall PO attainment by direct method (Contd...)

► Attainment of average POs by applying Eq. (3) against all the Courses of a Program for a particular batch of students is illustrated below:



(35/44)

Implementation

Evaluation of overall PO attainment by direct method (Contd...)

▶ Attainment of average POs by applying Eq. (3) against all the Courses of a Program for a particular batch of students is illustrated below:

Course	Course-wise attainment of POs							
	P01	PO2	PO3	PO4	PO5	PO6	PO7	PO8
ME999	2.33	1.33	0.83	-	2.00	2.00	1.67	1.46
ME980								
ME940								
ME900								
Direct PO	2.52	2.89	1.98	2.01	2.20	1.30	1.80	2.43
attainment, Z_m	Z_1	Z_2	Z_3	Z_4	Z_5	Z_6	Z_7	Z_8

Overall Program attainment

$$F = \left(\frac{1}{R_2 P} \sum_{m=1}^{P} Z_m\right) \times 100\% \tag{4}$$

Overall Program attainment

Plan

▶ Individual POs are helpful in understanding the performance in different components of a Program and also to take corrective measures for improvement

 $F = \left(\frac{1}{R_2P}\sum_{m=1}^{}Z_m\right) \times 100\%$ In Eq. (4), F = single percentage valued attainment of the Program, $Z_m =$ attainment of its mth PO as given by Eq. (3), P = total no. of PO of the Program, and $R_2 =$ scale point of the rubric system used in CO O correlation. This single-valued attainment of the Program is illustrated below.

PO attainment Implementation References

Overall Program attainment

- Individual POs are helpful in understanding the performance in different components of a Program and also to take corrective measures for improvement
- However, it may become difficult and also confusing to understand the overall attainment of a Program from multiple attainment values of its individual POs



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- ▶ This single-valued attainment of the Program is illustrated below:

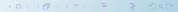
Overall Program attainment =
$$\left(\frac{17.13}{3 \times 8}\right) \times 100\% = 71.37\%$$

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- Design and evaluation of attainment of COs
- Design and evaluation of attainment of POs
- Implementation of the CO-PO attainment model
- References

(37/44)

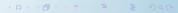
Implementation of the CO-PO attainment model



(38/44)

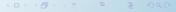
Implementation of the CO-PO attainment model

- Finally, how to implement the proposed model in computer for evaluating the CO-PO attainment?



Implementation of the CO-PO attainment model

- ► Finally, how to implement the proposed model in computer for evaluating the CO-PO attainment?
- Sequential steps for the same are presented below



(38/44)

- Read the following input data:
 - (a) N: Number of Courses participated in the evaluation of attainment of COs and POs
 - (b) C_i : Number of COs of the *i*th Course, i = 1 to N
 - (c) A_i : Number of assessment tools applied to the *i*th Course, i = 1 to N
 - (d) a_{ij} : Number of assessment tools by which the *j*th CO of the *i*th Course is evaluated i = 1 to C_i , i = 1 to N
 - (e) w_{ik} : Weightage to the kth assessment tool in the evaluation of CO attainment of the ith Course, k = 1 to A_i , i = 1 to N (required only if different weightages are given to different assessment tools)
 - (f) S_{ijk} : Attainment value of the *j*th CO of the *i*th Course as per the *k*th assessment tool k = 1 to A: i = 1 to C: i = 1 to N
 - (g) R_1 : Scale point of the rubric system used for evaluating CO attainment

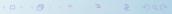
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(39/44)

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(39/44)

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(39/44)

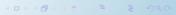
- ► Read the following input data:
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 - (b) C_i : Number of COs of the *i*th Course, i = 1 to N
 - (c) A_i : Number of assessment tools applied to the ith Course, i=1 to N

- ► Read the following input data:
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 - (c) A_i : Number of assessment tools applied to the *i*th Course, i = 1 to N
 - (d) a_{ij} : Number of assessment tools by which the *j*th CO of the *i*th Course is evaluated, j = 1 to C_i , i = 1 to N

- Read the following input data:
 - (a) N: Number of Courses participated in the evaluation of attainment of COs and POs
 - (b) C_i : Number of COs of the *i*th Course, i = 1 to N
 - (c) A_i : Number of assessment tools applied to the ith Course, i=1 to N
 - (d) a_{ii} : Number of assessment tools by which the jth CO of the jth Course is evaluated, i=1 to C_i , i=1 to N
 - (e) w_{ik} : Weightage to the kth assessment tool in the evaluation of CO attainment of the ith Course, k=1 to A_i , i=1 to N (required only if different weightages are given to different assessment tools)

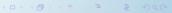
- ► Read the following input data:
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 - (d) a_{ij} : Number of assessment tools by which the *j*th CO of the *i*th Course is evaluated, j = 1 to C_i , i = 1 to N
 - (e) w_{ik} : Weightage to the kth assessment tool in the evaluation of CO attainment of the ith Course, k=1 to A_i , i=1 to N (required only if different weightages are given to different assessment tools)
 - (f) S_{ijk} : Attainment value of the *j*th CO of the *i*th Course as per the *k*th assessment tool, k = 1 to A_i , j = 1 to C_i , i = 1 to N

- Read the following input data:
 - (a) N: Number of Courses participated in the evaluation of attainment of COs and POs
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 - (e) w_{ik} : Weightage to the kth assessment tool in the evaluation of CO attainment of the ith Course, k=1 to A_i , i=1 to N (required only if different weightages are given to different assessment tools)
 - (f) S_{ijk} : Attainment value of the *j*th CO of the *i*th Course as per the *k*th assessment tool, k = 1 to A_i , j = 1 to C_i , i = 1 to N
 - (g) R_1 : Scale point of the rubric system used for evaluating CO attainment



Attainment of COs (Contd...)

► With the above input data, calculate the following:



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Attainment of COs (Contd...)

Plan

- ▶ With the above input data, calculate the following:
 - (1) x_{ii} : Attainment of the *i*th CO of the *i*th Course by Eq. (1b) or Eq. (1c) as required, i=1 to C_i , i=1 to N

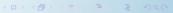
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- ► With the above input data, calculate the following:
 - (1) x_{ij} : Attainment of the *j*th CO of the *i*th Course by Eq. (1b) or Eq. (1c) as required, j = 1 to C_i , i = 1 to N
 - (2) X_i : Overall CO attainment of the *i*th Course in the form of a single percentage value by Eq. (1a), i = 1 to N

Note that, out of x_{ij} and X_i calculated above, only x_{ij} is required in the evaluation of PO attainment

- ▶ With the above input data, calculate the following:
 - (1) x_{ij} : Attainment of the *j*th CO of the *i*th Course by Eq. (1b) or Eq. (1c) as required, j=1 to C_i , i=1 to N
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- Note that, out of x_{ij} and X_i calculated above, only x_{ij} is required in the evaluation of PO attainment

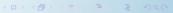




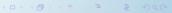
Attainment of POs

► Read the following input data:

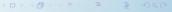
- ► Read the following input data:
 - (a) P: Number of POs of the Program



- ► Read the following input data:
 - (a) P: Number of POs of the Program
 - (b) N: Number of Courses participated in the evaluation of attainment of COs and POs (same as used in CO attainment)



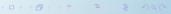
- ► Read the following input data:
 - (a) P: Number of POs of the Program
 - (b) *N* : Number of Courses participated in the evaluation of attainment of COs and POs (same as used in CO attainment)
 - (c) C_i : Number of COs of the *i*th Course, i = 1 to N (same as used in CO attainment)



- ► Read the following input data:
 - (a) P: Number of POs of the Program
 - N: Number of Courses participated in the evaluation of attainment of COs and POs (same as used in CO attainment)
 - (c) C_i : Number of COs of the *i*th Course, i=1 to N (same as used in CO attainment)
 - (d) x_{ii} : Attainment of the jth CO of the ith Course, j=1 to C_i , i=1 to N (calculated in CO attainment)

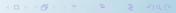


- ► Read the following input data:
 - (a) P: Number of POs of the Program
 - (b) N: Number of Courses participated in the evaluation of attainment of COs and POs (same as used in CO attainment)
 - (c) C_i : Number of COs of the *i*th Course, i = 1 to N (same as used in CO attainment)
 - (d) x_{ij} : Attainment of the *j*th CO of the *i*th Course, j = 1 to C_i , i = 1 to N (calculated in CO attainment)
 - (e) l_{im} : Number of COs of the *i*th Course correlated to the *m*th PO, m=1 to P, i=1 to N



- Read the following input data:
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 - (e) l_{im} : Number of COs of the *i*th Course correlated to the *m*th PO, m=1 to P, i=1to N
 - (f) y_{iim} : Weightage of the jth CO of the jth Course to the mth PO, m=1 to P, j=1to C_i , i=1 to N

- Read the following input data:
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 - (d) x_{ii} : Attainment of the jth CO of the ith Course, j=1 to C_i , i=1 to N (calculated in CO attainment)
 - (e) l_{im} : Number of COs of the *i*th Course correlated to the *m*th PO, m=1 to P, i=1to N
 - (f) y_{iim} : Weightage of the jth CO of the jth Course to the mth PO, m=1 to P, j=1to C_i , i=1 to N
 - (g) R_2 : Scale point of the rubric system used for correlating COs with POs



Attainment of POs (Contd...)

▶ With the above input data, calculate the following:

 z_{im} : Attainment of the mth PO against the ith Course by Eq. (2)

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 Z_m : Direct attainment of the *m*th PO over the entire Program for a liven batch of students by Eq. (3), m=1 to P

B) F : Single percentage valued attainment of the Program by Eq. .

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Attainment of POs (Contd...)

- ▶ With the above input data, calculate the following:
 - (1) z_{im} : Attainment of the mth PO against the ith Course by Eq. (2), m=1 to P, i = 1 to N

- ► With the above input data, calculate the following:
 - (1) z_{im} : Attainment of the mth PO against the ith Course by Eq. (2), m=1 to P, i=1 to N
 - (2) Z_m : Direct attainment of the *m*th PO over the entire Program for a given batch of students by Eq. (3), m = 1 to P

Attainment of POs (Contd...)

- With the above input data, calculate the following:
 - (1) z_{im} : Attainment of the mth PO against the ith Course by Eq. (2), m=1 to P, i = 1 to N
 - (2) Z_m : Direct attainment of the mth PO over the entire Program for a given batch of students by Eq. (3), m = 1 to P
 - (3) F: Single percentage valued attainment of the Program by Eq. (4)

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Thanks a lot

for your patience in listening

The tedious presentation!!

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