TALE - 2 Course Design and Instruction of Engineering Courses
Prof. K Rajanikanth
Former Principal - MSRIT
Indian Institution of Science, Bengaluru

Lecture - 08
Assessment Pattern and Assessment Instruments

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Greetings, welcome to Module 2, Unit 8 on Assessment Patterns and Assessment Instruments.

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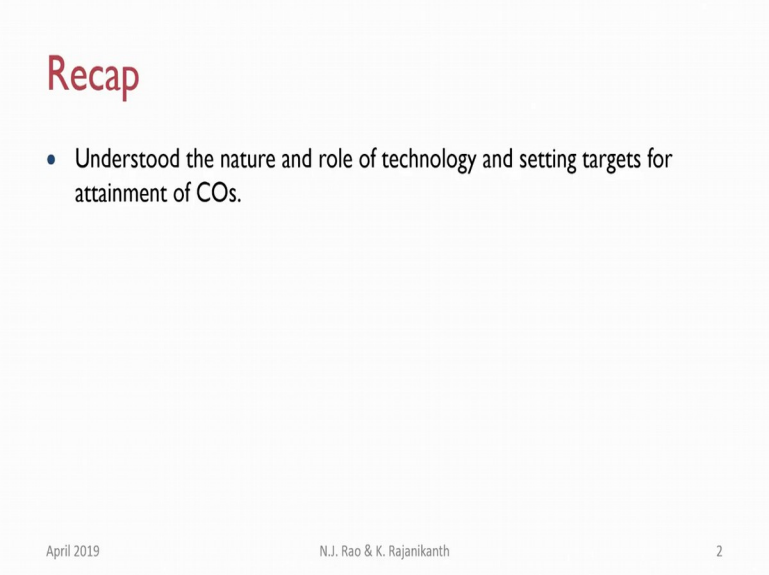

We have seen the nature and role of technology in setting targets for attainment of COs.

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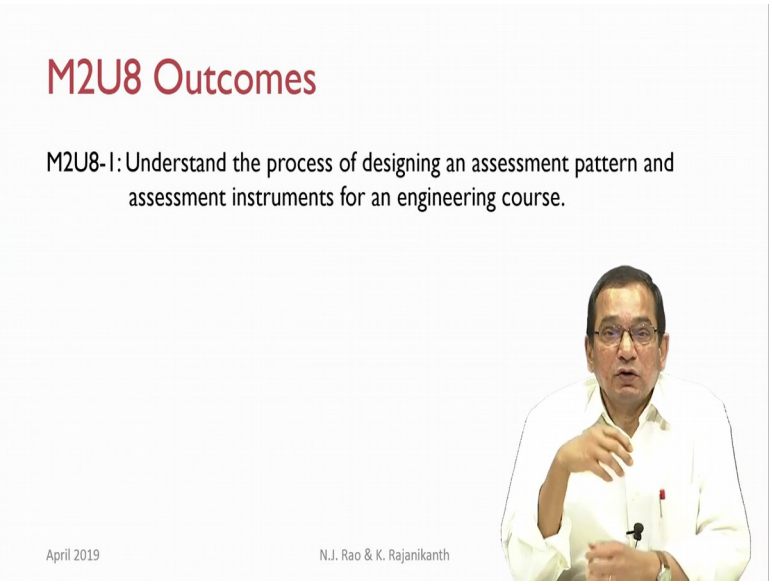

The outcomes for this unit are: to understand the process of designing an assessment pattern and assessment instruments for an engineering course.

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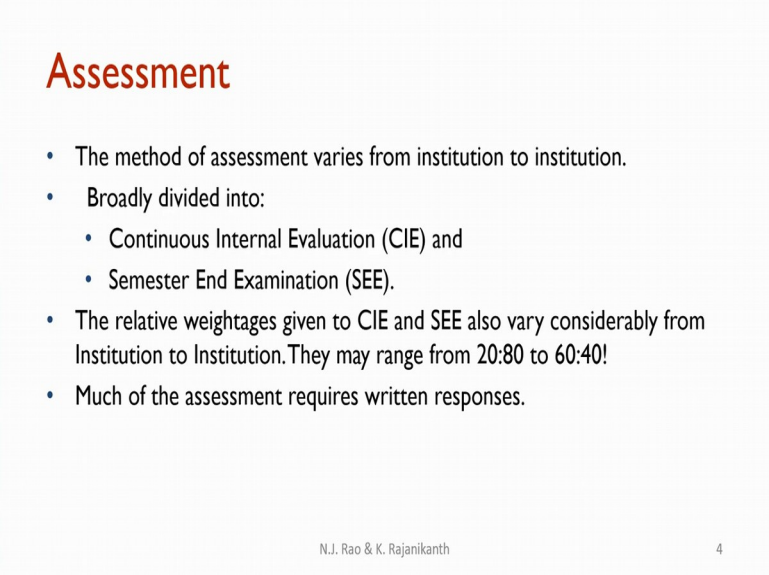

The method of assessment varies dramatically from institution to institution. We have a very large amount of variation in the way the assessment is implemented in different universities and in different institutions. But very broadly we can divide the assessment into two parts: the continuous internal evaluation and semester end examination. The

relevant weightages given to the CIE and SEE also vary considerably from institution to institution. In Tier 2 institutes which are affiliated to university, typically the weight given to the CIE is around 20 and the weightage to the semester end examination is 80. So, that is 20:80.

But that can vary and go all the way up to 60:40 in autonomous institutes. So, there are institutes (autonomous) which allocate 60 marks to SEE and 40 to CIE, but the more common allocation in autonomous institute is 50:50 and non-autonomous affiliated institutes is 20:80. These are the most common numbers, but they do vary across the universities and the institutes and much of the assessment still requires written responses as of now.

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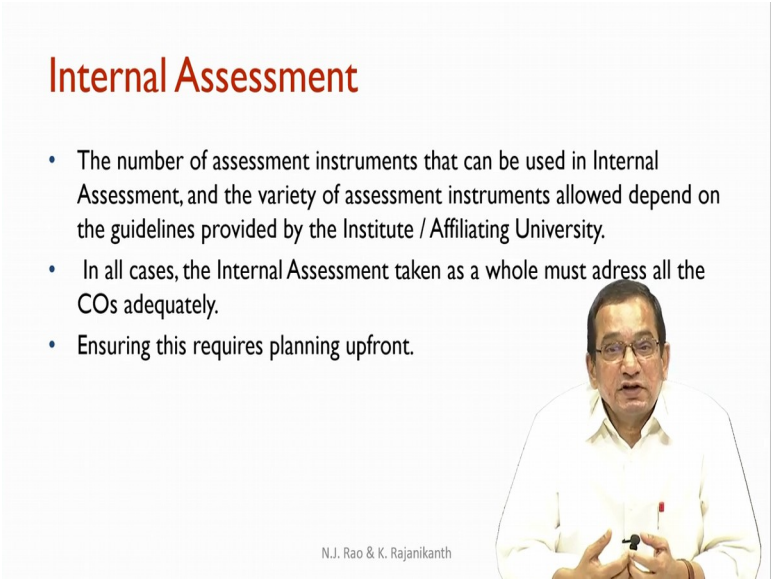

The continuous internal evaluation or internal assessment: with respect to this, the number of assessment instruments that can be used in continuous internal assessment and the variety of assessment instruments allowed depend on the guidelines provided by the institute or affiliating university. There can be again wide variation. There are universities where you can conduct only two tests as a part of CIE and their average is taken as the CIE marks. There are institutes where 3 tests are conducted and the best 2 are selected and their average is taken as the CIE.

There are also institutes where the teacher has freedom with respect to certain marks of the CIE and the teacher can administer quizzes, assignments, mini projects for certain

marks. For certain marks, this has to be necessarily in the form of written test. So, the variation of the possible assessment instruments and the type of questions that can go into these instruments varies dramatically across the institutes. But in all cases the internal assessment taken as a whole must address all the COs adequately and this is a major challenge for many institutes. Particularly, it becomes challenge to assess the later COs.

For example, if there are 8 COs, assessing COs 7 and 8 is generally a challenge. Because by the time the instruction material uncovers the CO7 and CO8, usually the last test would have been conducted. So, there are challenges in designing the internal assessment in such a way that all the COs are addressed adequately and ensuring all these requires considerable planning upfront. Without that, it is possible that the CIE will be inadequate in providing the data for computing the CO attainment.

So, in this unit we focus on the planning upfront that is required to ensure a quality CIE as well as quality SEE.

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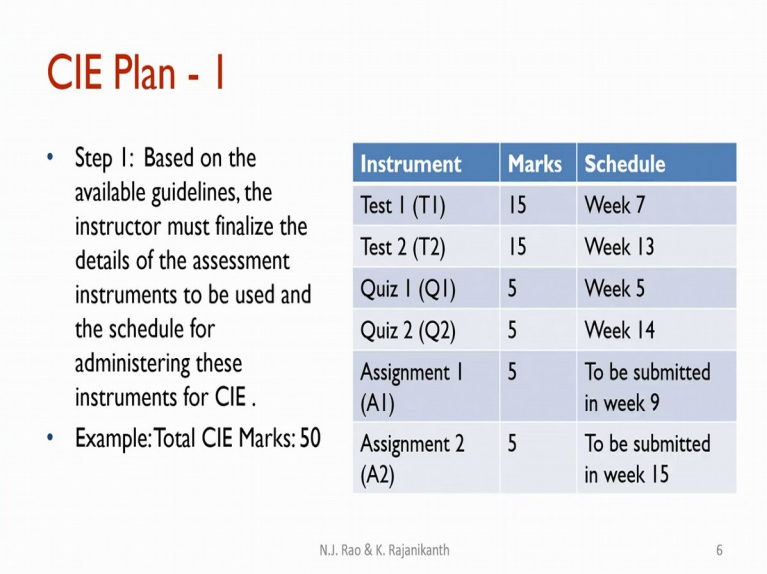

The first step in CIE will be: Based on the available guidelines, the instructor must finalize the details of the assessment instruments to be used and the schedule for administering these instruments for CIE. As I mentioned, there can be only 2 tests or there can be 2 tests and certain quizzes or there can be tests, quizzes, assignments or there can be tests then a mini project. So, in all these cases we must finalize first the

details of these assessment instruments and the marks allocated for them as well as the schedule when that particular instrument is going to be administered.

What we see here is one example, where the instructor is planning on 2 tests, each for 15 marks; then 2 quizzes, each for 5 marks and 2 assignments, again each for 5 marks, getting to a total of 50 marks. And the schedule as you can see is that Test 1 and Test 2 are scheduled in week 7 and week 13. The 2 quizzes are scheduled in week 5 and week 14 and the assignments 1 and 2 - one is to be submitted in week 9 and another is to be submitted in week 15. Now, when these assignments are given to the students - that the instructor has to decide depending upon how much time is to be allowed to the student to work on the assignment and submit.

But it is assumed that the assignment topic is indicated to the student reasonably well in advance and the week in which it is to be submitted is known upfront. So, the first step would be to make this kind of a plan; the assessment instruments to be used and the schedule for the administering these instruments.

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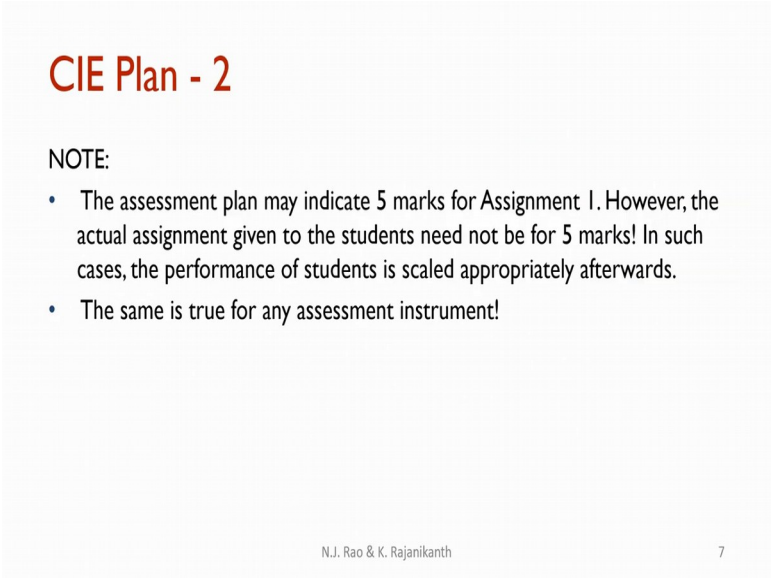

It should be noted that what is indicated in the assessment plan would be the final marks. For example, assignment 1-it says 5 marks, but the actual assignment given to the students need not be for 5 marks. I can give it for say 20 marks, but what will happen in such cases is that the performance of the students is scaled appropriately towards the end. That means, an assignment 1 is given for 20 marks then the final marks are divided by 4

so that the performance of the students is scaled appropriately. This becomes necessary when designing quizzes and assignments because the total marks allocated to them would be small and designing an instrument for such a small number of marks may not be very convenient.

So, I may design the quiz for 20 marks, and then scale it down to 5 marks. This kind of a scaling down can happen for any assessment instrument based on the need and convenience of the instructor.

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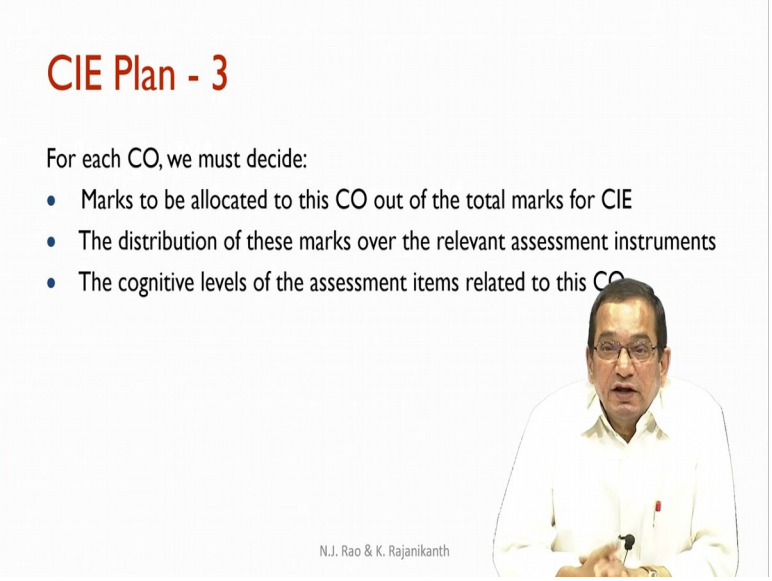

After deciding on the assessment instruments and their schedule, we must now look at the COs. For each CO, there are three things that we must decide. Number one: marks to be allocated to the CO out of the total mark for the CIE. So, we have for example, 50 marks for CIE and how many marks will be allocated to CO1, CO2, CO3 etcetera. So, marks to be allocated for a particular CO - that we must decide. Then, the distribution of these marks over the relevant assessment instruments - it is possible that we cover a particular CO over 2-3 assessment instruments.

For example, CO1 would be addressed in test 1 as well as in quiz 1 as well as in assignment 1; then how many marks would be allocated in test 1; how many would be in Q 1 and how many would be in assignment 1? We will have to decide that. Then: the cognitive levels of the assessment items related to this CO. This we will discuss again in

detail, but we have to decide on the cognitive levels of the assessment items related to this CO.

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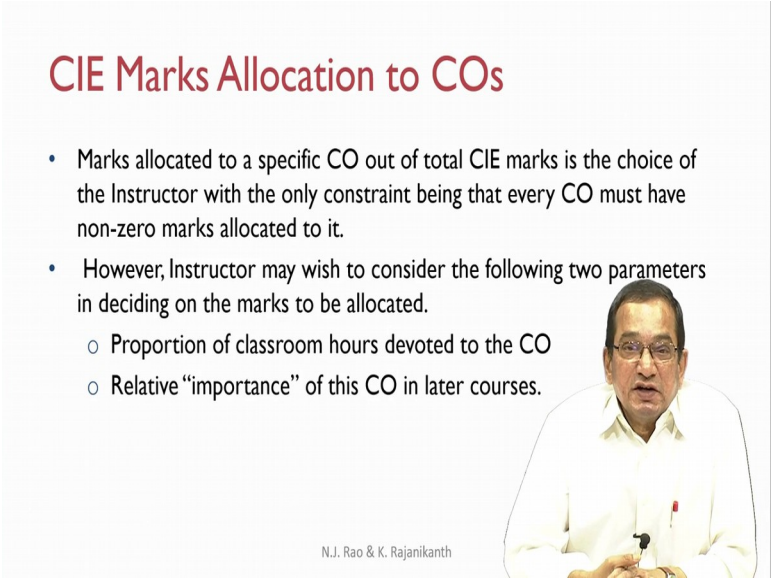

So, the first is marks allocation - marks allocated to a specific CO out of the total CIE marks. Obviously, is the choice of the instructor. The only constraint is that every CO must be assessed; which means that non-zero marks must be allocated to every CO. Beyond that, it is instructors' choice. However, it may be desirable if the instructor considers two important parameters in deciding on the marks to be allocated. One is the proportion of classroom hours devoted to that CO. We spend considerable amount of time devoted to a particular CO, but if number of marks allocated to that CO is significantly low, it does not look very natural.

So, the proportion of the classroom hours devoted to the CO plays an important role. But it is not algorithmic in the sense that so many percentage of the classroom is devoted to the CO; so, the same percentage of 50 is devoted to that CO. It is not like that, but it is an important parameter that a teacher must take into account. And also the subjective perception about the relative importance of that CO in later courses - that also can be taken into account. Based on these parameters finally, the instructor has to decide how many marks are to be allocated to a specific CO.

So, that freedom still rests with the instructor, but these are the parameters that can be taken into account in deciding on that number.

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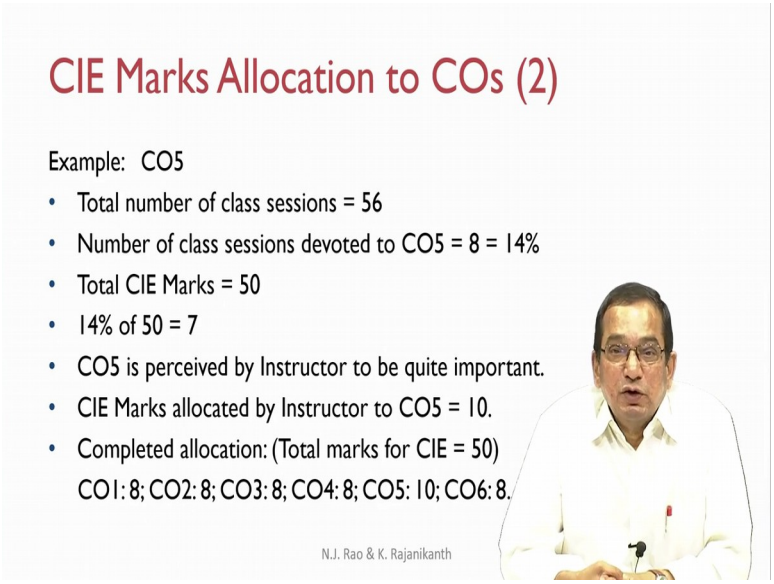

As an example, in a course let us look at one CO - CO5. Assume that the total number of class room sessions is 56 and the number of class room sessions devoted to CO5 is 8, that is 14 percent and the total CIE marks is equal to 50. So, if you go strictly by the same percentage, then we will get 7 marks. It is possible to allocate 7 marks only to the CO5, but the instructor perceives this CO5 to be more important or significant for the later courses. So, the instructor has allocated actually 10 marks to CO5, which is perfectly all right.

So, the marks allocated to a particular CO by the instructor depend on these two factors. But finally, it is the design choice of the instructor. So, for CO5 the marks allocated are 10. In the same fashion instructor has to decide the marks to be allocated to each CO and of course, total must come to whatever the marks assigned for CIE. In this case the total marks for CIE are 50. So, the marks allocation, let us assume, is as shown here. All the COs other than CO5 - 8 marks each; then CO5 is 10. So, we have 8x5 = 40; plus 10; 50 marks.

This choice is the choice of the instructor. It is not necessary that CO1, CO2, CO3, CO4 and CO6 all must carry the same weight of 8. In this case the instructor has decided like that, but it can vary from CO to CO based on the factors that we discussed. So, the instructor has to decide on this kind of CIE marks allocation to COs.

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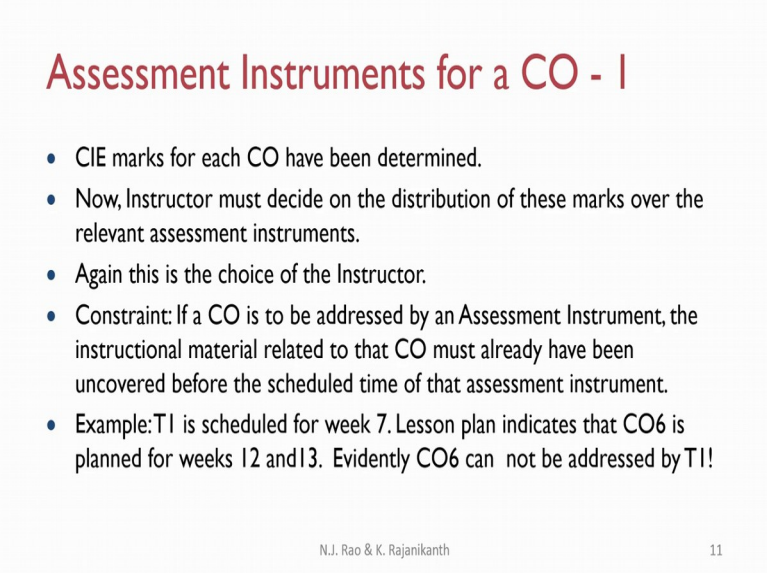

Then, for each CO we already have determined the marks. Now, the instructor must decide on the distribution of these marks over the relevant assessment instruments. Again, this is the choice of the instructor. Essentially, what we are saying is that a particular CO is addressed by which all instruments? The only constraint is that if a CO is to be addressed by an assessment instrument, the instructional material related to that CO must already have been uncovered (must have been discussed in the class and completed) before the scheduled time of that particular assessment instrument. As an example, we saw that T1 is scheduled for week 7.

Now, lesson plan indicates that CO6 is planned for weeks 12 and 13. Evidently CO6 cannot be addressed by T1. In fact, this used to be a major handicap in the earlier scheme of internal evaluation, where there are only 2 tests and by the time the test 2 is completed, in most of the cases, the instructors would have covered the instruction material related only to the probably the first 4 or 5 COs. So, the remaining COs still are to be covered as per the lesson plan, but already the last assessment instrument is over!

So, essentially we had no performance data regarding some of the later COs. This was one of the major drawbacks in that kind of assessment scheme. So, several autonomous institutes realized this very early and they brought in other assessment instruments; other than tests; which could be administered later in the semester to address the later COs. Otherwise it becomes very difficult to address the later COs. So, the other assessment

instruments like a quiz or an assignment will become absolutely essential to cover the later COs.

So, keeping this constraint in view, the instructor has to decide the assessment instruments that would be used to address a particular CO.

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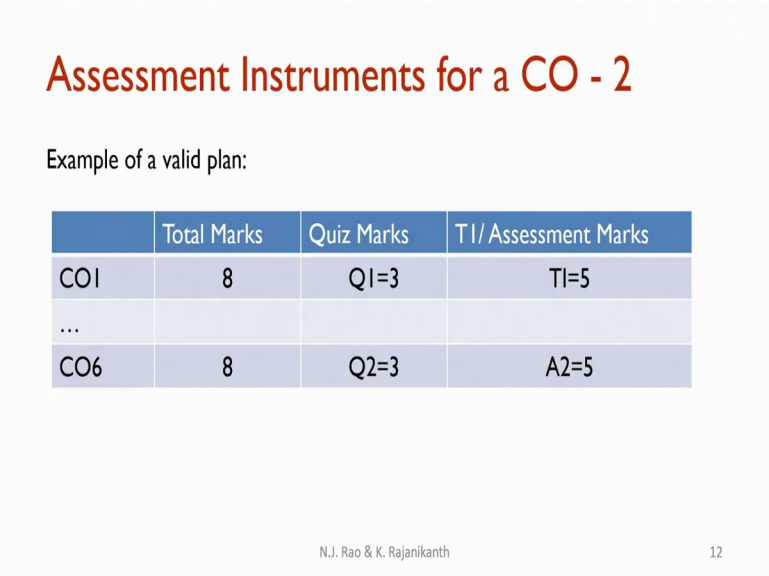

So, this is an example of a valid plan. By valid what we mean is that the time at which the assessment instrument is scheduled - by that time the instruction material related to that CO has been completed in the classroom. So, CO1- the total marks allocated already, we have seen is 8 and the allocation of the marks for this is in quiz 1- 3 marks are allocated and in T1 - 5 marks are allocated; total 8 marks and by the time the quiz 1 is conducted or the T1 is conducted; the material related to CO1 has been completed in the class room.

So, the student is ready to take the quiz 1 and T1 which have questions related to CO1. Similarly for every CO, we must decide what are the assessment instruments in which that CO is to be addressed. So, assume that we have done that for every CO. For example, CO6 which is the very last CO of the course - we can see that it is not covered by any test at all because by the time we complete the test 2, still we have not really touched on the material related to CO6.

The instructional material related CO6 comes in much later only. So, this CO6 is not addressed by Test 1 or Test 2; instead to some extent, it is addressed by quiz 2 for 3 marks. But the remaining marks - they are all addressed in the assignment 2 and we have seen that the scheduled date for submission of assignment 2 is quite late.

So, by that time, the instruction material related to CO6 would have been completed reasonably well and a student has time enough to complete the assignment and submit it. So, this kind of a plan is essential in order to ensure that every CO is addressed reasonably well in one or more assessment instruments spread over the semester.

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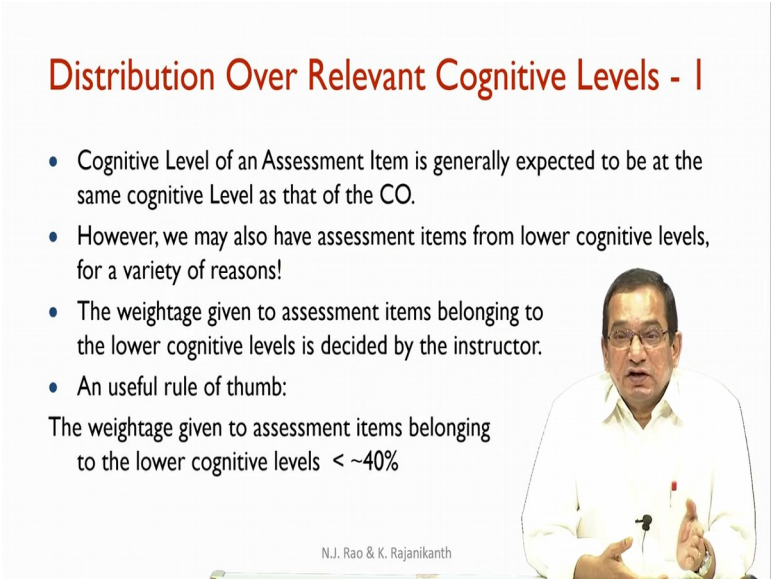

After determining the marks to be allocated to a CO and after determining the assessment instruments over which that CO is to be addressed, the next major issue to be decided is the distribution of marks over relevant cognitive levels. Now in general the cognitive level of an assessment item is expected to be at the same level as that of the CO. If the CO is at the analyze level, it is expected that the assessment item is also at the analyze level. If the CO is at the apply level the assessment item also should be at apply level.

However, in practice most of the instructors do set the assessment item at lower cognitive levels for a variety of reasons. It could be that it is important to assess even a lower level. It could be that they would like to first test at that level and see the progress of the students in terms of acquiring competencies stated. So, there could be a variety of

reasons because of which we may have assessment items from lower cognitive levels. So, if a particular CO is at apply level, I may have certain questions related to that CO at the lower levels of understanding and remember.

That means, related to that CO, I can have some questions at a remember level, some questions at apply level and some questions at the understand level also. So, the weightages given to the assessment items belonging to the lower cognitive levels is decided by the instructor. If a CO is at apply level, how many marks do I allocate to apply level and how many marks do I allocate to the lower levels which are understand and remember.

Of course, within that how many marks to understand level; how many marks to remember level is also the choice of the instructor. But one useful rule of thumb is that the weightage given to assessment items belonging to the lower cognitive levels should not exceed 40 percent. Of course, this 40% is not a magic figure! You could decide on 35 percent, you could decide on 30 percent; the instructor has that freedom to decide. But if it is more than 50 percent then, the assessment looks to be weak.

If a CO is at apply level and if our assessment items are addressing only lower levels predominantly, but not the apply level; then, usually the assessment is considered as of inferior quality. And of course, in order to the ensure that this is not happening, it is usually a practice that is followed by many institutes that the assessment instruments go through some kind of a quality assurance process, where the instrument is validated against these kinds of guidelines.

So, it is also necessary to have some kind of guidelines like what could be the maximum weightage that can be given to assessment items belonging to lower cognitive levels. The 40 percent is a reasonable number that we are proposing, but the instructor has the freedom to change this number. But have some kind of prior thought as to what can be the percentage of marks allocated to lower cognitive levels.

In fact, again if you look in to the semester end question papers in the earlier times before the OBE framework, many of the people complained that the question papers have questions all related to very low cognitive levels of remember and sometimes only the remember and understand, even though the expected competencies from the student were at higher cognitive levels. So, the instructor has to have upfront planning to ensure

that the question paper is of reasonable quality; the assessment instruments that are being planned do address the COs sufficiently at the relevant cognitive levels. So, this is a choice that the instructor must make.

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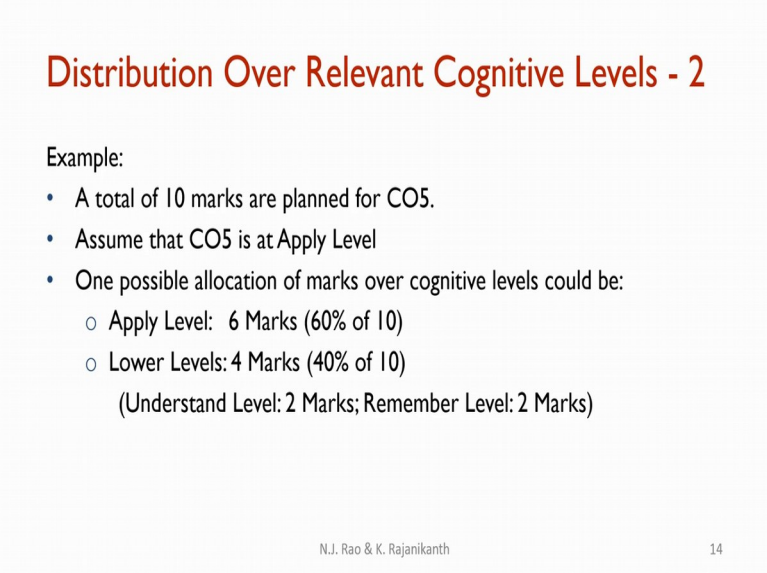

One example again: We have seen CO5. A total of 10 marks are planned for CO5. Now assume that CO5 is at apply level; then how many marks do I allocate to apply level and how many marks do I allocate to lower levels of understand and remember. So, this is one choice where the instructor has decided to have 6 marks for assessment items at apply level and 4 marks for assessment items at lower levels. These 4 marks are again split into 2 marks at understand level and 2 marks at remember level.

Now, it may look like this is too much of a detail, but this kind of a planning is essential if the assessment is to be of good quality and we already have seen that good quality assessment is the key to good quality learning. Assessment drives the learning. So, unless the assessment is planned upfront carefully, there is no guarantee that the assessment would be of good quality. So, though it does look like fair amount of detail, it is necessary to ensure that all the assessment items address all the COs at relevant cognitive levels. So, this kind of a planning is almost absolutely necessary to ensure good quality assessment.

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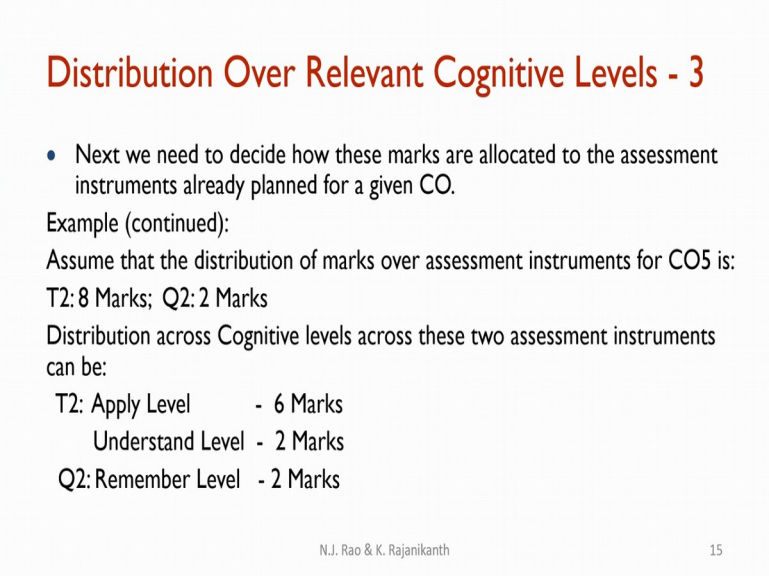

The next major issue is that having decided on the distribution of marks to different cognitive levels, we need to decide how these marks are allocated to assessment instruments already planned for a given CO. For a CO, we already have decided what all the assessment instruments which should address that CO. Now, we already have decided how many marks to be allocated to that CO; at what cognitive levels.

Now the final decision is how are these marks to be distributed over the assessment instruments. For example, assume that the distribution of marks over assessment instruments for CO5 is Test 2 - 8 marks and Quiz 2 - 2 marks. Notice this is the same example which we had earlier - we are continuing. Now, distribution of marks across these two instruments - we will have to decide. We already have decided that at apply level we need 6 marks and the issue is that these 6 marks would belong to T2 and at understand level, we wanted 2 marks and these 2 marks also will be in T2 and at remember level, we need 2 marks and these will be covered in Quiz 2.

So, the distribution of marks related to CO5 across cognitive levels, across the relevant assessment instruments is as follows: In Test 2, there will be assessment items for 6 marks at apply level related to CO5. There will be an assessment item at understand level for 2 marks related to the same CO5 and in Quiz 2, there will be 2 or 1 item at remember level which will be for 2 marks related to CO5. So, this completes the plan process for a particular CO and this, we must do for all COs. For all COs, we must decide total marks

allocated to that CO, the assessment instruments in which that CO is going to be addressed and the cognitive levels over which the assessment is to be distributed.

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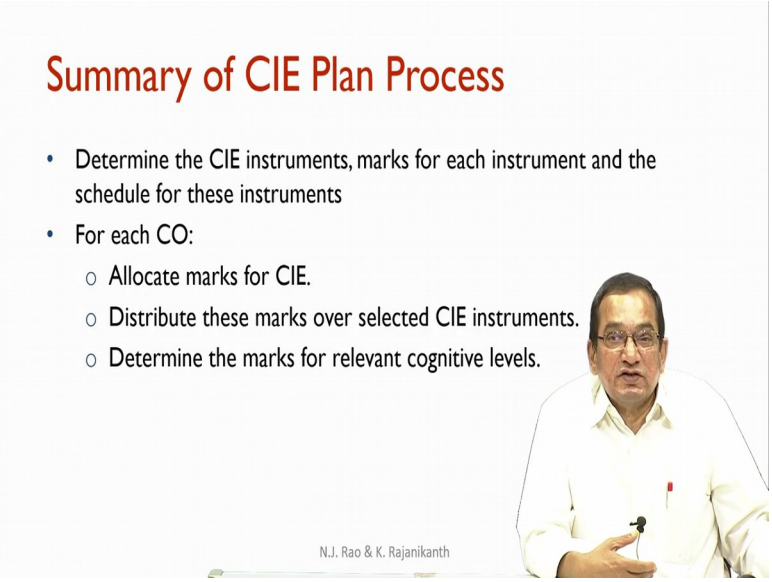

So, that leads us to a summary of the CIE plan as shown below. Determine the CIE instruments, mark for each instrument and the schedule for these instruments - that is first step. Then, for each CO allocate marks for CIE; distribute these marks over the selected CIE instruments; and determine the marks for relevant cognitive levels.

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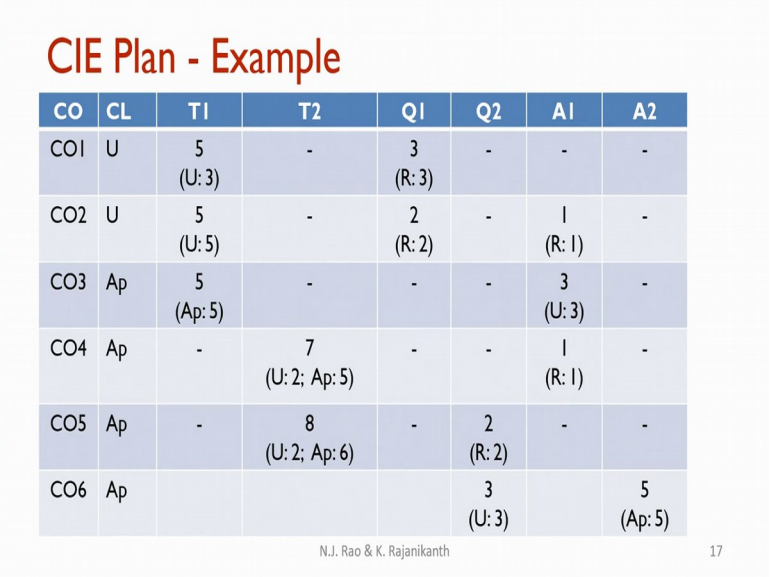

CO	CL	T1	T2	Q1	Q2	A1	A2
CO1	U	5 (U: 3)	-	3 (R: 3)	-	-	-
CO2	U	5 (U: 5)	-	2 (R: 2)	-	1 (R: 1)	-
CO3	Ap	5 (Ap: 5)	-	-	-	3 (U: 3)	-
CO4	Ap	-	7 (U: 2; Ap: 5)	-	-	1 (R: 1)	-
CO5	Ap	-	8 (U: 2; Ap: 6)	-	2 (R: 2)	-	-
CO6	Ap				3 (U: 3)		5 (Ap: 5)

If you do that, then we may get a table like this. The actual cognitive level of CO1 is "Understand" and that is being covered in T1 that is Test 1 and Quiz 1. In Test 1, 5 marks are allocated and in a Quiz 1, 3 marks are allocated. So, basically the CO1 is being covered in two instruments T1 and Q1 and in that the understand level, there will be 3 marks in T1; its not shown here, but it means that the remaining 2 marks go to the remember level.

So, in T1 also we have done certain marks at one level and remaining marks at lower level. Similarly, CO2: you can see it is covered in T1, Quiz 1 as well as the assignment 1. So, this is spread over 3 assessment instruments. CO3 which is at apply level is addressed in T1 and in assignment 1 (A1).

Similarly, CO4 is addressed in T2 and in assignment 1, then CO5 in T2 and quiz 2 and CO6 - you notice is not addressed in any of the test at all - neither T1 nor T2 - it is addressed only in quiz 2 and assignment 2 which come much later. So, basically what needs to be done is that the marks for the CO which have been allocated are spread over different cognitive levels; the same cognitive level and lower cognitive levels and they are spread over different assessment instruments for the CIE.

So, that completes the CIE plan process. Of course, we have to ensure that the total number of marks for T1, T2, Quiz 1, Quiz 2, assignment 1 and assignment 2 - they are as per the original plan. So, the total marks allocated to each assessment instrument are as per the original plan and the scheduled test assignments and quizzes - they all occur at a time by which the addressed COs have been completed in classrooms and the cognitive levels are all appropriately planned.

How many marks at the cognitive level which is same as the cognitive level of the CO, how many marks at lower levels; all these planning have been completed. That leads to a final table which we have shown here. This would be the CIE plan though it looks a little bit detailed; this ensures that the CIE first addresses all COs then addresses the COs at appropriate cognitive levels and the time at which the assessment happens is reasonable. So, this is the CIE plan that we must have.

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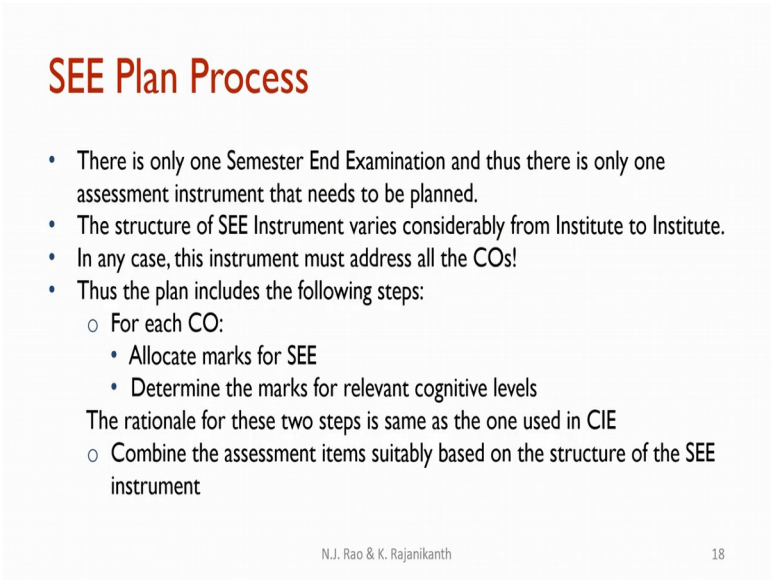

Then, let us move on to the SEE - semester end examination. What is involved in that? There is only one semester end examination and thus, there is only one assessment instrument that needs to be planned. So, there is nothing like multiple assessment instruments, there is only one. The structure of the SEE instrument varies considerably from institute to institute, university to university. Obviously, whatever may be the structure it must address the entire COs; that is important thing. So, the plan that we have for SEE includes the following steps.

For each CO allocate marks for SEE, and then determine the marks for relevant cognitive levels. So, these two steps only are required and the rationale for these two steps is the same as the one used for CIE. That means, based on the proportion of classroom hours spent to that CO and the relative importance of that CO, you decide on the total marks for that CO and then, decide on how many marks at the cognitive level of the CO and how many marks at lower levels.

Now, these assessment items must be combined suitably based on the structure of the SEE instrument. That is one additional step because often SEE has got a fixed structure and the assessment items need to be combined appropriately in order to create the final SEE instrument. We will have a look at the possible structures.

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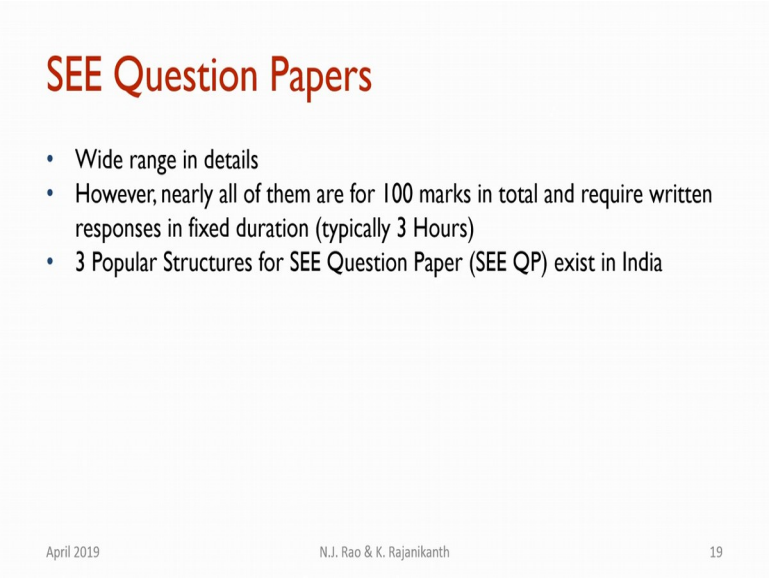

So, they vary very widely in details, but nearly all of them are for 100 marks in total, though later they may be scaled to 50, if the SEE, CIE ratios are 50:50. Then, these 100 marks will be scaled to 50. If they are in the ratio of 20:80 (CIE:SEE), then they may be scaled to 80. So, ultimately, they may be scaled differently, but the question paper itself is generally for 100 marks in total and generally requires written response and the duration is generally fixed; typically 3 hours in Indian scenario. There are 3 popular structures for SEE question paper right now in India. There are many variations, but broadly there are three kinds of structures which are available.

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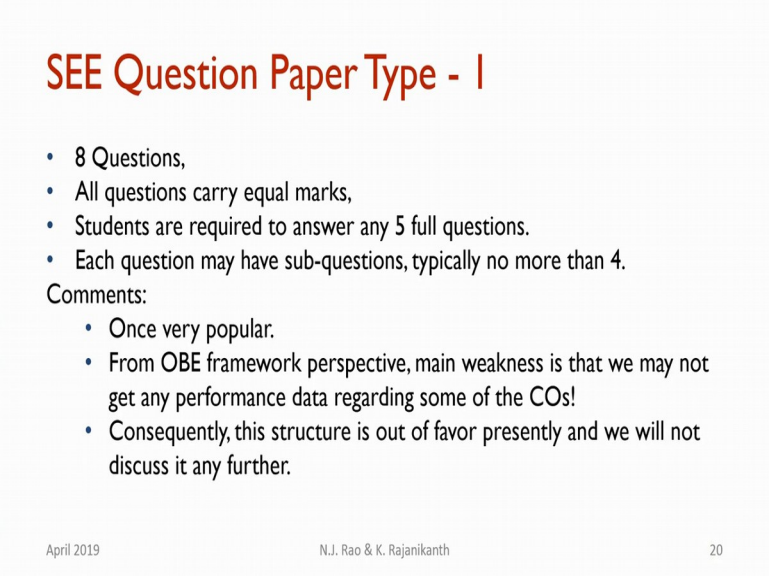

Type 1: There are 8 questions; all questions carry equal marks. Students are required to answer 5 full questions. That means, each questions is for 20 marks. Each question may have sub-questions like a, b, c, d. But typically the sub questions are no more than 4 and the allocation of marks for these sub questions can be fairly arbitrary; like I may have 3 sub questions. So, I may have marks like 4+ 4+ 12 adding to 20 or I may have 6+ 6+ 14 or I may have 3+ 5+ 12; practically it's arbitrary. The instructor has unrestricted freedom with respect to the number of sub-questions and the marks allocated to each sub question.

However, if such a planning is done, then we will see later that creating an item bank becomes very difficult. So, it may be desirable to have some kind of structure for the sub-questions also. We will examine that when we look into the item banks. Now, this kind of question paper structure was once very popular, but today it is really not favored by any institute. Because from OBE framework perspective, the weakness is that we may not get any performance data regarding some of the COs; particularly COs related to the later portion may be skipped by the students and sometimes even by the teacher.

So, the 5 questions to be answered will all belong to the earlier part of the syllabus and the COs related to that part are essentially focused upon. This was again realized very early by autonomous institutes. So, this structure is totally out of favor today and only a very small number of institutes are still following this structure; practically it is going out of favor and we will not discuss this any further.

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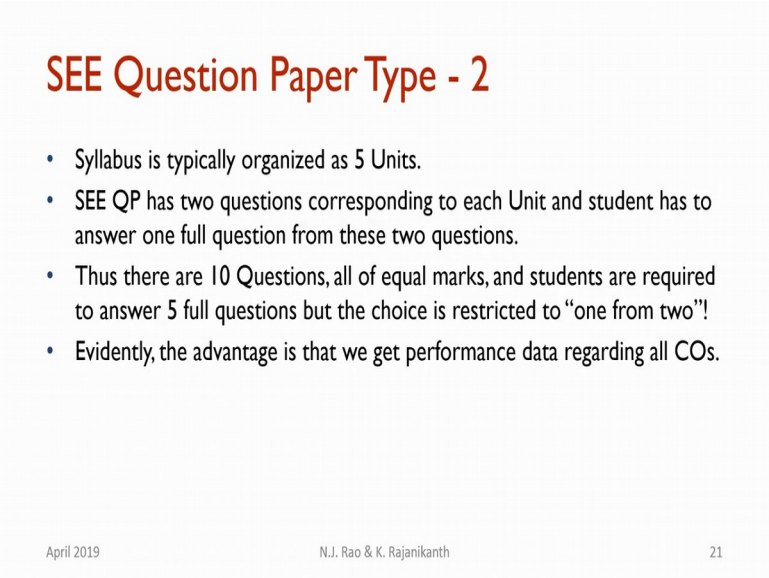

Type 2: Here it is based on the fact that in most of the OBE adopted frameworks, the syllabus is typically organized into 5 units and the semester end examination question paper has 2 questions corresponding to each unit and the student has to answer one full question from these two questions. That means, there is a choice, but is internal choice. The 2 questions correspond to the same unit and the student has to answer one of them; that means, the student has to answer a question from each unit.

So, there are 10 questions, all are of equal marks and students are required to answer only 5. It looks like there is a bigger choice. But actually the choice is restricted to 1 from 2. So, there are 2 questions from unit 1, student has to answer, 1 question. Similarly, 2 from unit 2, student has to answer 1 question; in that way it is always a choice of 1 from 2. Obviously, the advantage is that we get performance data regarding all COs because the 5 units essentially are written down as certain number of COs. This is fairly popular and many autonomous institutes as well as many universities have adopted this type much more prominently these days.

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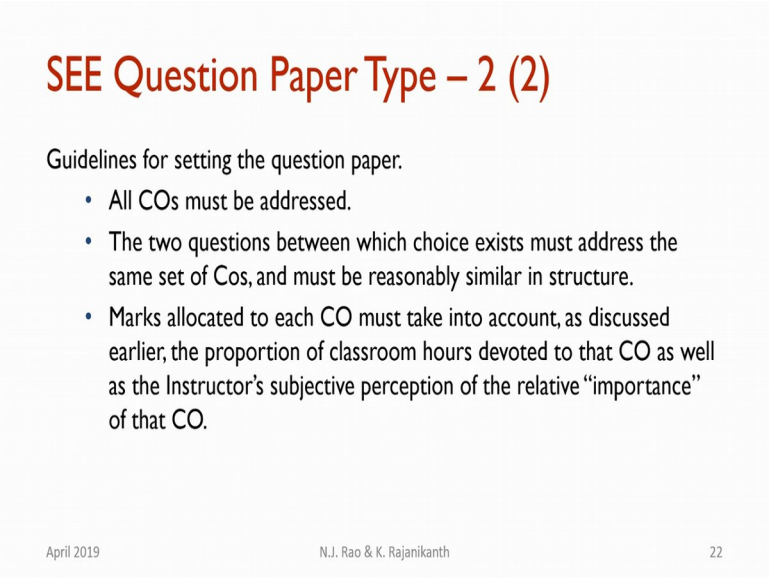

The guidelines for setting such a question paper would be that obviously, all the COs must be addressed. But the important point is the two questions between which choice exists, for example, question 1 and 2 related to the first unit, the two questions between which choice exists must address the same set of COs and must be reasonably similar in structure. Then only the performance data can be used reasonably well to determine the attainment levels of the COs.

If the question 1 is addressing CO1 and CO2 and the choice is with question 2; question 2 also must address CO1 and CO2 and they must be reasonably similar in structure in the sense that if CO1 is given a weight of 8 and CO2 is given a weight of 12 in one question, the choice also must be quite similar - CO1 again 8 marks, CO2 - 12 marks. The subdivision could vary, but the total marks allocated must be similar.

The cognitive levels chosen also must be similar in structure. It does not mean that there cannot be any variation, but the variation should be minimal. So, in other words, the 2 questions offered for choice must be quite similar in terms of the COs addressed, the cognitive levels addressed so that the performance data that we get would be a reliable one for determining the attainment levels of the COs. So, the marks allocated to each CO must be taken into account as discussed earlier, the proportion of classroom hours devoted to that CO as well as the instructor's subjective perception of the relative

importance of that CO. Just as with CIE, with SEE also we use same the rationale for determining the marks.

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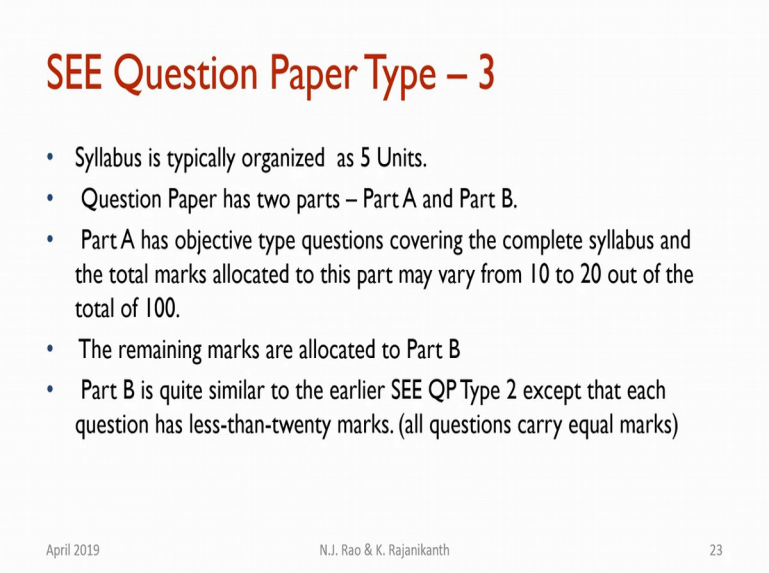

There is a 3rd type which has become more prominent these days in some of the universities, where the question paper has two parts - Part A and Part B. Part A has objective type questions covering the complete syllabus and the total marks allocated to this part may vary from 10 to 20 out of the total of 100. The remaining marks are allocated to part B and the structure of part B is quite similar to the SEE question paper type 2. That means, the syllabus is organized in to 5 units; for each unit there are 2 questions; the student has to answer 1 of those 2 questions. So, the choice is 1 out of 2, total 10; student has to answer 5; 1 from each unit.

The only difference is that each question will now have lesser number of marks because some marks are allocated to part A. For example, if part A has got 20 marks, part B has got only 80 marks. So, the 5 questions are equally distributed among 80. So, each question will have only 16 marks instead of 20 marks; otherwise, the structure is quite similar to the SEE question paper type II.

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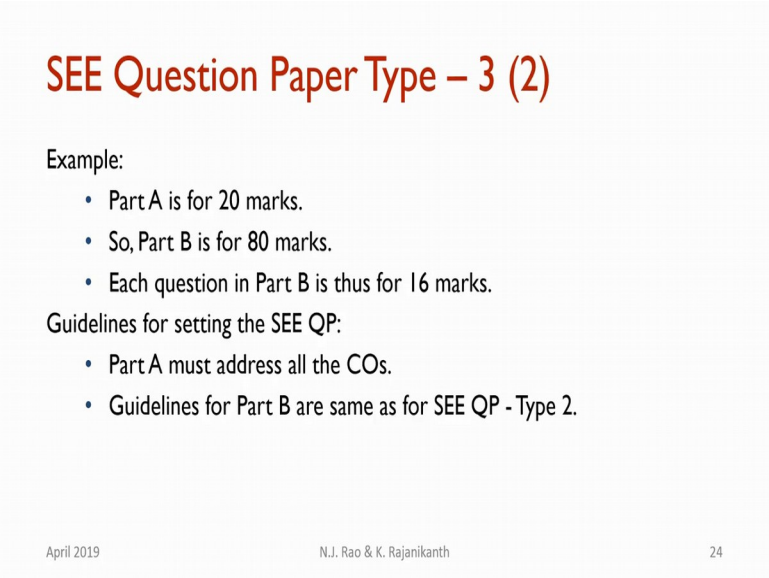

Now, the guidelines for setting the SEE question paper are fairly simple. Part A must address all the COs. And then, based on how many objective type questions are in part A, one can decide how many should be devoted to each CO. Again, using the relative importance of each CO, the relative number of hours spent for each CO, the number of objective questions belonging to a CO can be decided.

Now, the guidelines for part B are absolutely same as for the SEE question paper type 2 because there is really no difference from SEE question paper type 2, the only difference being that it is for lesser number of marks. Otherwise it is the same structure that we need to have.

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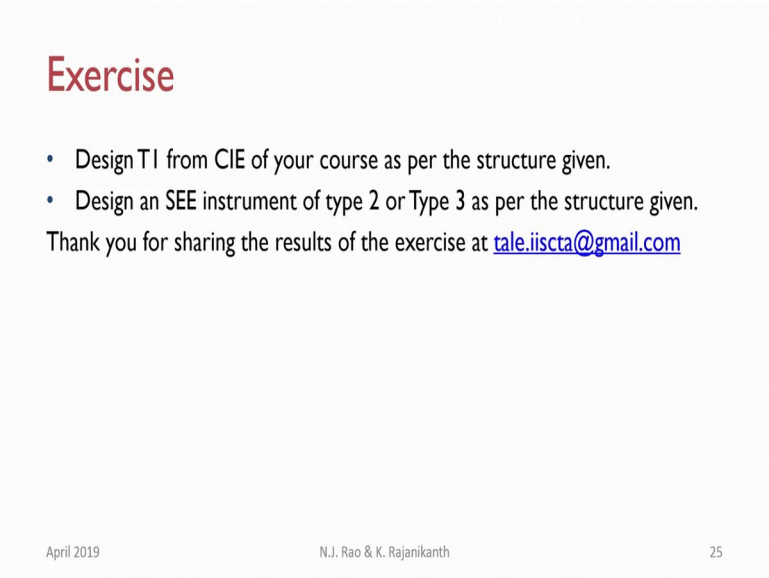

That completes our discussion of the assessment plan for CIE and SEE. So, the exercise is design one test T1 that is part of the continuous internal evaluation of your course as per the structure given. Indicate the COs being addressed, their cognitive levels, the schedule when the T1 is occurring and when the relevant COs would have been uncovered in the classroom. Design one SEE instrument of type 2 or type 3 - basically there is no difference except that in type three certain marks are given to objective type questions - as per the structure given. And thank you for sharing the results of these exercises at tale.iiscta@gmail.com.

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In our next unit, we will understand the process of designing an item bank. What is an item bank; why do we need an item bank; what are the advantages of item bank and what is the structure of an item bank and how do we design an item bank.

Thank you for your attention and with this we conclude this unit.