NBA Accreditation and
Teaching – Learning in Engineering
(NATE)
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Lecture 19
Tagging Course Outcomes

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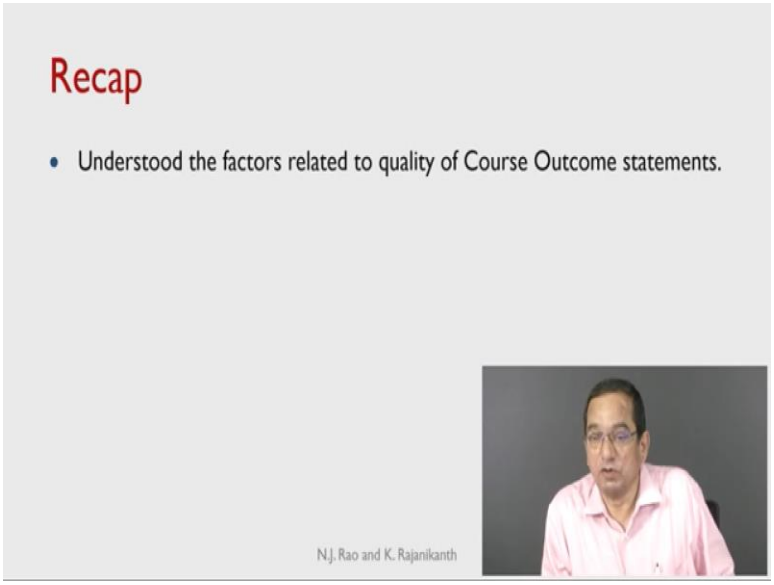

Greetings, welcome to module 1, unit 18, Tagging the Course Outcomes. In the previous unit we understood that the factors related to the quality of Course Outcome statements. We examine how to write outcomes statements of good quality, what kind of errors could be committed while writing the outcome statements and we also presented a checklist to ensure that the outcome statements are of good quality.

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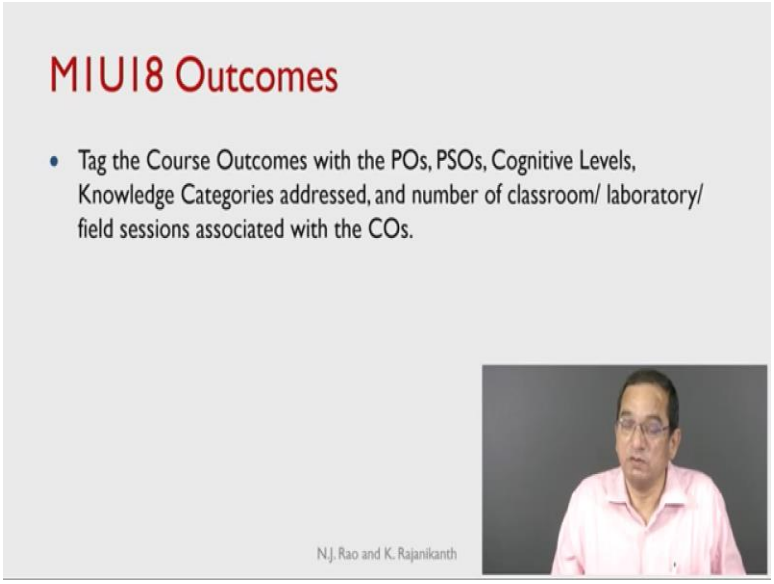

In this unit we will look at tagging the course outcomes with the POs program outcomes PSOs program specific outcomes, cognitive levels, knowledge categories addressed and the number of classroom, laboratory and field sessions associated with the COs. We will also look at the rational of why we need to tag the outcome statement with these elements.

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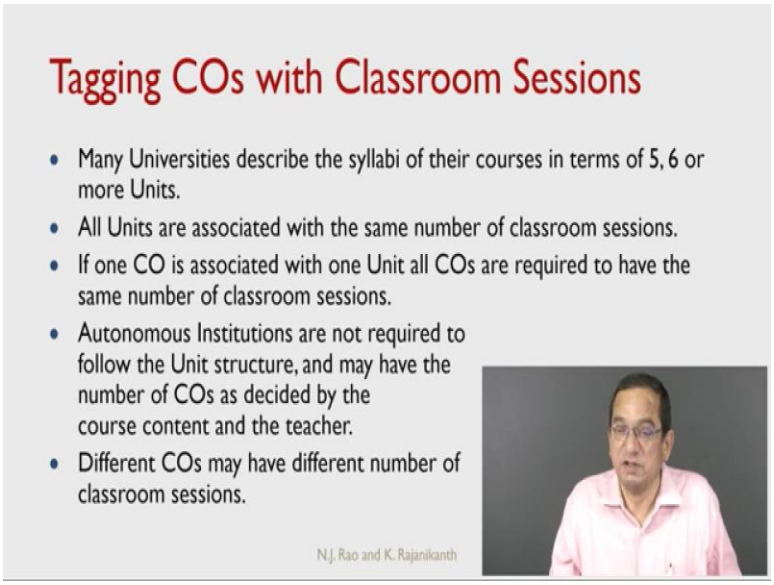

Many universities describe the syllabi of their course in terms of units 5 or 6 or more units. All units are associated with the same number of classroom sessions typically. If the policy is to associate one CO with 1 unit then all the COs will necessary have the same number of classroom

sessions. Because the units are equal sized, if there is one CO for 1 unit then all CO will have the same number of classroom sessions associated with them.

Autonomous institutions are not required to follow the unit structure and may have the number COs as decided by the course content and the teacher. Thus, different COs may have different number of classroom sessions. And, we need to tag the COs with the number of sessions associated with that CO, whether classroom sessions or laboratory sessions or field sessions or combination of these. Why should be tag a CO with the number of sessions?

Later we will see that the COs have to be mapped to POs and PSOs and their mapping strength has to be determine. We will see that associating the number of sessions required with a particular CO would help us in determining the mapping strength. Another useful indicator would be that if the number of classroom sessions is too small or too large it may be a pointer to an outcome statement that may not be of very good quality.

If the number of classroom sessions associated with a particular CO is too small, probably the CO is too specific and if the number of sessions is too large probably the CO is also too abstract. Again, there is no hard and fast tool as to what is the correct number of sessions that should get associated with a particular outcome.

But, very broadly we could say that if the number is too small or if the number is too large probably we need to have re-look at the CO. That is another reason why we try to figure out the number of classroom sessions associated with a particular CO.

This is only an approximate number teacher can write this number based on her experience of delivering the course it does not have to be a very exact figure, it can be an approximate round figure that indicates roughly how much time would be required to deal with the learning material related to that particular outcome.

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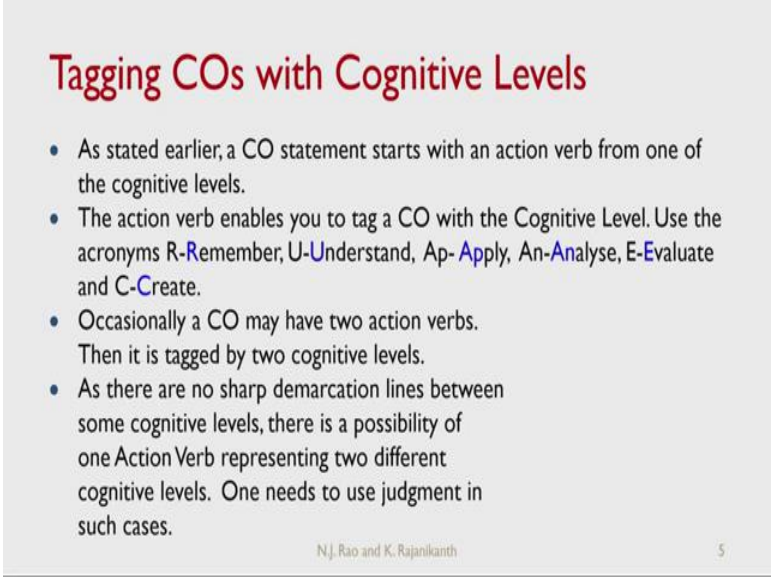

We have seen that the CO statement starts with an action verb from one of the cognitive levels, so we should tag the CO with the associated cognitive level. The action verb enables you to tag the CO with the cognitive level. We can use for simplicity sake, the acronyms R for remember, U for understand, Ap for apply, An for analyze, E for evaluate and C for create. This is only for convenience one could write the full name also.

Occasionally we have seen that a CO may have 2 action verbs then it is tagged by 2 cognitive levels. If we look at the way the action verbs are associated with the cognitive processes. We have seen that sometimes the same action verb may be associated with 2 different cognitive processes. For example, we have seen that distinguish can be associated with understand, the cognitive process of understand.

As well, it can be associated with the cognitive process of analyze. So tagging the CO with a cognitive level requires some judgments form the teacher. We should not use the action verb blindly to determine what is the cognitive level associated with this particular outcome statement. There is no sharp demarcation line between some cognitive levels, there is a possibility of one action verb representing two different cognitive levels.

So, one needs to use judgement in such cases. Now we tag the CO with the cognitive level because when it comes to assessment we need to determine what should be the cognitive level of the assessment item. What should be the cognitive level of the question related to this CO, thus

we need to tag the CO with the cognitive level and also we should have outcomes at higher cognitive levels in order to promote deep learning.

So, when we tag the COs with the cognitive levels if you find that almost all the COs are at very low cognitive levels, then we may have to relook at the way the course is planned to be delivered. Thus, it is necessary to tag the CO with the cognitive levels.

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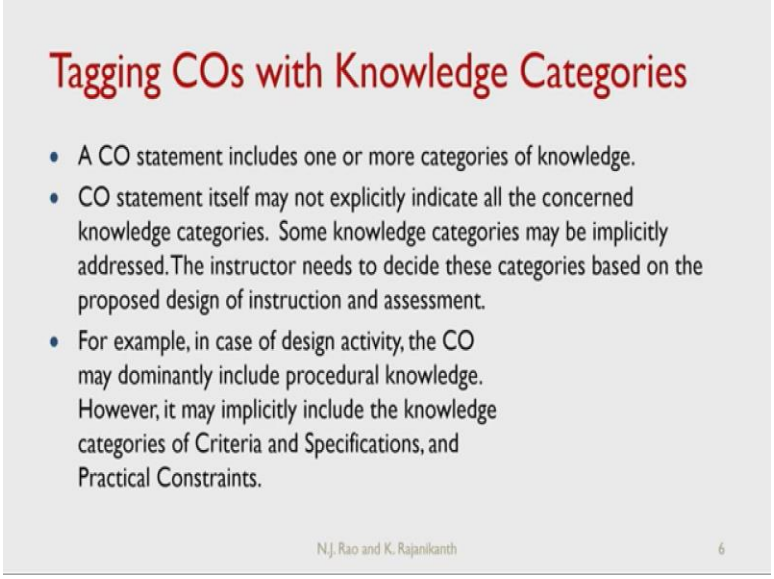

Next we must tag the COs with knowledge categories, a CO statement includes one or more categories of knowledge and CO statement itself may not explicitly indicate all the concerned knowledge categories. Some knowledge categories may be implicitly addressed. The instructor needs to decide these categories based on the proposed designed of instruction and assessment.

As an example consider a design activity, the CO may dominantly include procedure knowledge we are assuming that the design is actually an apply activity. So, the CO may dominantly include procedure knowledge, however it may implicitly include knowledge categories of criteria and specifications and practical constraints. These may not be explicitly stated in the CO statement but instructor must infer these based on a proposed deign of instruction and assessment.

Now, why should be tag the outcome with the knowledge categories? The way the instruction is planned would depend on the nature of knowledge category. If what the student is suppose to learn and demonstrate has a knowledge component which belongs to the procedure knowledge,

then the way is instruction is design would be different if the knowledge is to be of the conceptual nature then the instruction would be different.

Thus tagging the outcome statement with the knowledge category would be helpful in designing an appropriate instruction. However it is also true that in a very large number of institutes including autonomous institutes much attention is really not paid to the knowledge categories. The cognitive process alone is considered as an important attribute. However, if we can make good use of the knowledge categories in designing the instruction we will be helping the students with better learning.

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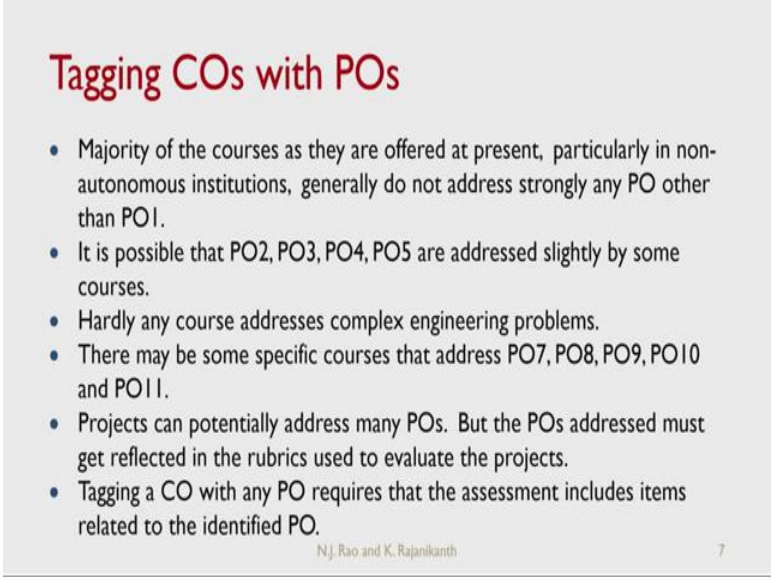

We already know that students are expected to attain program outcomes specified by the NBA and program specific outcomes PSOs specified by the university or by the department. We also know that they have PO and PSOs are to be attained through courses, laboratory works, project works and other activities in which all the students take part. Of these activities courses contribute in a major way to the attainment of POs and PSOs.

Thus, we need to know what are the POs and PSOs which get attain when a particular CO is attain. In other words, what is a relation between the CO and the POs and PSOs? If a particular CO is attained by the student what does it mean in terms of the attainment of the PO and PSO. Which POs and PSOs get attain because of the attainment of this particular CO.

So, we need to map the COs to the relevant POs and PSOs. Again, there is no specific algorithmic way of doing this mapping. The teacher has to look at the course content, what is implied by the outcome statement, the program outcome statements, program specific outcome statements, what are implied by those statements and then see what are the POs and PSOs to which a particular CO is related.

In fact, if we look at majority of the courses as they are offered at present, particularly in non-autonomous institutions. They generally do not address strongly any PO other than PO 1. It is possible that PO 2, PO 3, PO 4 and PO 5 are addressed slightly by some courses, but that is also rather doubtful but it is possible in some curriculum. Hardly any course addresses complex engineering problems. In fact the complexity of an engineering problem is not touched up on in any curriculum.

There may be some specific courses that address PO 7, PO 8, PO 9, PO 10 and PO 11. Even some activities may address PO 12 engineering society, environment and sustainability, ethics, teamwork, projects, management and finance, communication, self-learning, lifelong learning. These outcomes probably are addressed by some specific courses in some curriculum. Projects can potentially address many POs.

But the POs addressed must get reflected in the rubrics used to evaluate the projects. Tagging a CO with any PO requires that assessment includes items related to the identified PO. Not only assessment, instructions must clearly indicate that it is facilitating the attainment of that particular PO. For example, if you tag a CO with PO 12, PO 12 is lifelong learning. We must show instructional activities design to facilitate learners acquire the knowledge skills and attitudes required for lifelong learning.

We must also show that, that particular aspect is also assessed. Thus tagging a CO with any PO requires that both instruction and assessment include items related to that identified PO. So the mapping has to be done with certain care to ensure that the mapping can be justified.

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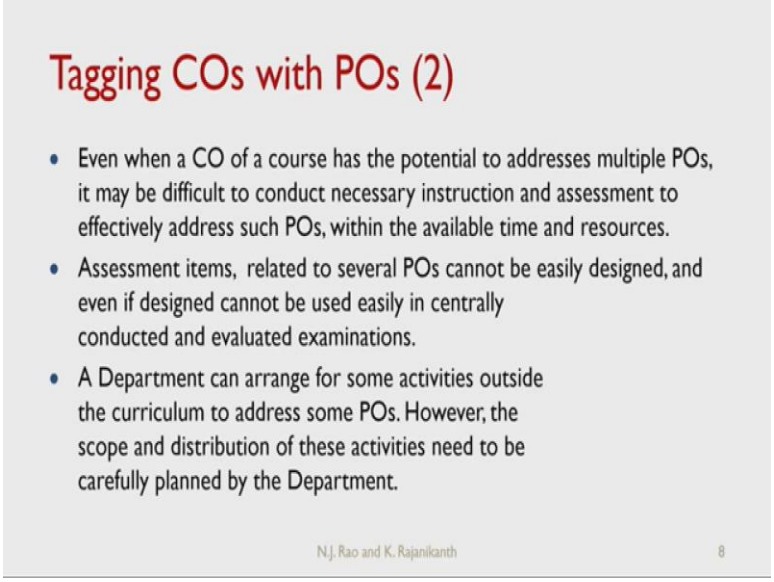

Even when a CO of a course has the potential to address multiple POs, it may be difficult to conduct the necessary instruction and assessment to effectively address such POs within the available time and resources. The constraint is that we have very limited time and the availability of other resources also could be limited. Thus, even though the course has the potential to address multiple POs, it may be difficult to conduct the necessary instructional assessment.

Teacher has to use to discretion and if it is possible, feasible to conduct the necessary instructional assessment then she can map the CO to those POs. Assessment items, related to several POs cannot be easily designed and even if designed cannot be used easily in centrally conducted and evaluated examinations.

A department can arrange for some activities outside the curriculum to address some POs. For example, a department may include activities designed to promote lifelong learning among the students. However, the scope and distribution of these activities need to be carefully planned by the department. How much time would it consume? What are the resources required?

All these things have to be considered carefully by the department and then we can map the CO to those POs. Thus, the mapping of CO with POs requires considerable care and careful examination of the instruction as well as assessment that is being planned for that course.

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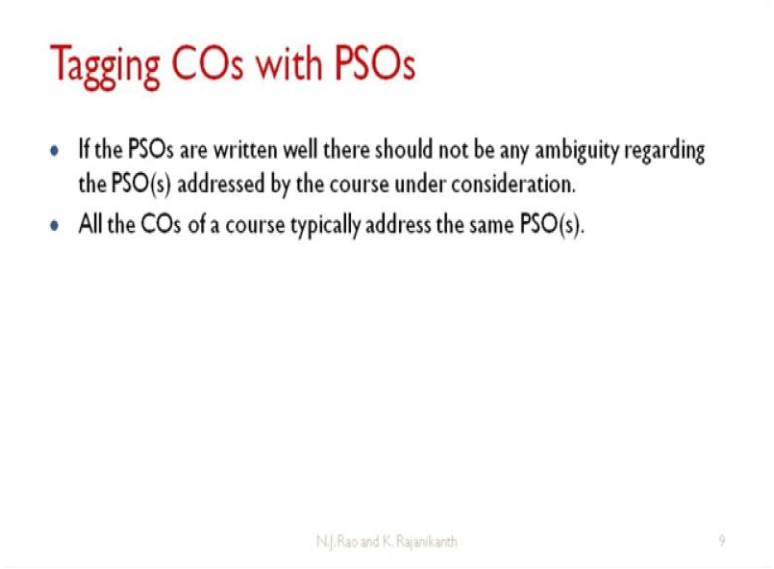

We need also tag COs with PSOs, if PSOs are written well there should not be any ambiguity regarding the PSOs addressed by the course under consideration. All the COs of a course typically address the same PSO or PSOs. Most often it is a single PSO that address that gets addressed by a course. But occasionally there may be more than 1 PSO that is addressed by the course. But all the COs of a course typically address the same PSO or PSOs

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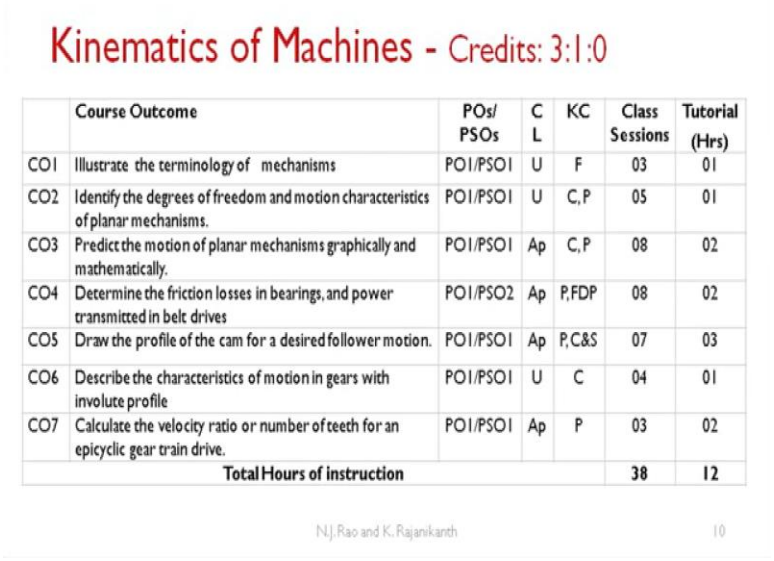

	Course Outcome	POs/ PSOs	C L	KC	Class Sessions	Tutorial (Hrs)
CO1	Illustrate the terminology of mechanisms	PO1/PSO1	U	F	03	01
CO2	Identify the degrees of freedom and motion characteristics of planar mechanisms.	PO1/PSO1	U	C,P	05	01
CO3	Predict the motion of planar mechanisms graphically and mathematically.	PO1/PSO1	Ap	C,P	08	02
CO4	Determine the friction losses in bearings, and power transmitted in belt drives	PO1/PSO2	Ap	P,FDP	08	02
CO5	Draw the profile of the cam for a desired follower motion.	PO1/PSO1	Ap	P,C&S	07	03
CO6	Describe the characteristics of motion in gears with involute profile	PO1/PSO1	U	C	04	01
CO7	Calculate the velocity ratio or number of teeth for an epicyclic gear train drive.	PO1/PSO1	Ap	P	03	02
	Total Hours of instruction				**38**	**12**

This is an example of one mapping, kinematics of machines credits 3-1-0, which means it is a 3 hours of theory then 1 hour of tutorial and there is no laboratory session. So if you see there are 7

outcomes which are written there. Let us look at as an example, the first outcome CO 1 illustrate the terminology of mechanisms.

Now this has 3 classroom sessions and 1 tutorial that means totally 4 hours. Now 4 hours looks somewhat small but it may be acceptable but the teacher has to have a relook at this CO, is it alright as an outcome statement of good quality. So there is a first sanity check that we can have, the number of sessions, the number of classroom sessions, tutorial sessions, laboratory sessions, field sessions devoted to a particular CO.

Then it gets mapped to PO 1 and PSO 1. The cognitive level, CL indicates cognitive level, is at understand level and KC is knowledge category this is factual knowledge. So that is how we do the mapping the CO is mapped to PO, PSOs, cognitive level, knowledge category. The number of classroom sessions including tutorials and laboratories devoted to this particular CO. If you look at the second CO that is also mapped to PO 1 and PSO 1.

That is also it be cognitive level of understand, but the knowledge category is both conceptual and procedural and the number of sessions devoted to that CO is 6, 5 classroom sessions and 1 tutorial session. So a total of 6 looks reassembly okay. So that is how we should look at the way we have written the COs and a see if they are appropriate.

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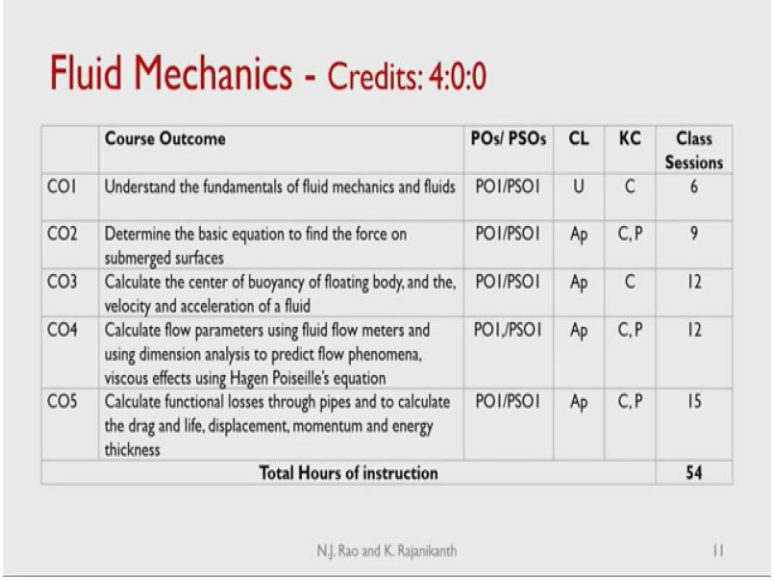

This is another example, fluid mechanics credits 4-0-0, that means 4 classroom hours per week there are no tutorials, no laboratory sessions. Now if you see the first one CO 1 understand the

fundamentals of fluid mechanics and fluids that is also getting mapped to PO 1 and PSO 1, the cognitive level is understand, knowledge category is 6 and there are 6 classroom sessions.

But if you look at this course CO 5 for example has 15 classroom sessions devoted to that. Now 15 looks like a very large number 15 out of total of 54 sessions, it looks like a very large number, designing instruction, designing assessment, may be somewhat difficult when we have an outcome of such a large magnitude scope. So thus one has to relook. In fact if you look at these it almost looks as if there are 5 units and there are 5 outcomes with 1 outcome corresponding to each unit.

It may not be like that but it looks like that or there is a constraint that every course must have exactly 5 outcomes. Thus we see that when we impose restrictions like that sometimes the outcome statements may not be of good quality. So one has to use once discretions if one is adopting a policy like that, so 15 looks somewhat heavy.

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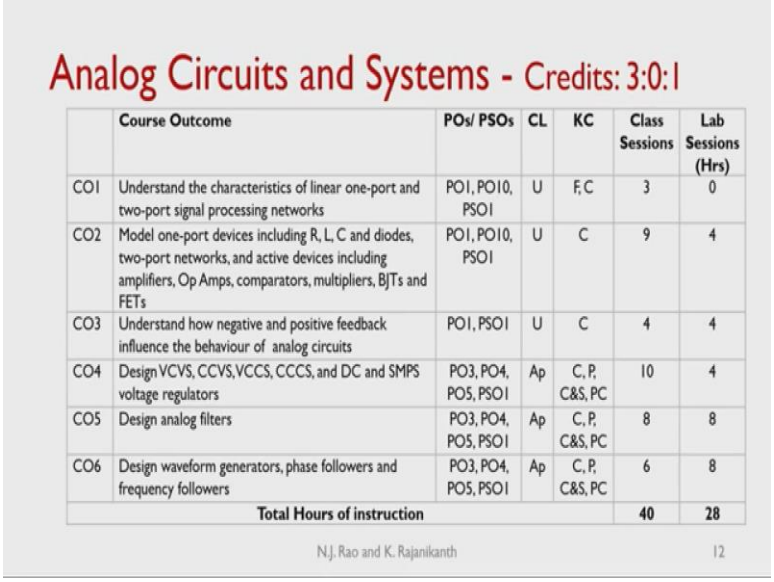

Let us look at another course, Analog Circuits and Systems and this is 3 is to 0 is to 1 that means 3 hours of classroom sessions, no tutorials, 1 laboratory session, 1 laboratory session typically would mean 2 hours. Now this has got 6 course outcomes, the first one, understand the characteristics of linear one-port and two-port signal processing networks. It is getting mapped to PO 1, PO 10, and PSO 1 and the cognitive level is understand, the knowledge categories are factual and conceptual.

There are 3 classroom sessions, there is no laboratory associated with this CO. So again if you see 3 looks like a very small number. So is the CO at a fairly low level of abstraction and is it too narrow? We may have to revisit and look at that CO. Finally, we may decide that this is acceptable but it needs a review. Similarly if you look at CO 4, design VCVS, CCVS, VCCS, CCCS and DC and SMPS voltage regulators. It is getting mapped to PO 3, PO 4, PO 5, PSO 1.

It is at the cognitive level of apply and the knowledge categories include the conceptual knowledge, procedural knowledge, criteria and specifications and practical constraints. But if you look at the number of sessions devoted to this CO, it is 10 classroom sessions and 4 hours of laboratory. So again it looks somewhat a heavy outcome, but after review the teacher may decide that this is acceptable.

So this is how after writing course outcome statements we must map them to POs, PSOs, cognitive level, CL is cognitive level, knowledge categories, KC is knowledge categories. The number of sessions, classrooms, laboratory as well as if there are field sessions, field sessions devoted to that particular CO.

This would help us to first review whether the COs are appropriate then it would help us in computing the attainment of COs, determining the mapping strength from COs to POs and PSOs. And finally in determining the attainment of POs and PSOs. Thus, this is an extremely important step in the total OBE process. Tagging the course outcomes with relevant items.

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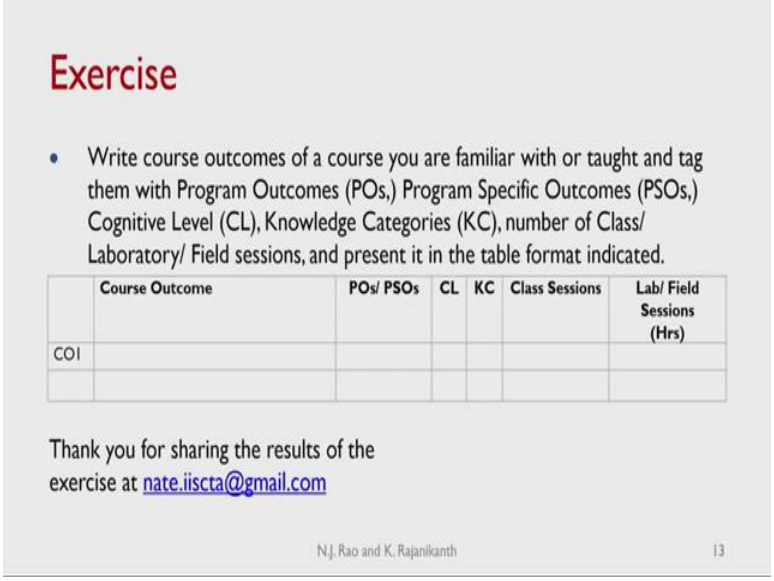

So an exercise, write course outcomes of a course you are familiar with or taught and tag them with Program Outcomes, Program Specific Outcomes, Cognitive Level, Knowledge Categories, number of classroom, laboratory, field sessions associated with that particular CO and present it in the table format indicated. O

nce again please note that POs are Program Outcomes, PSOs are Program Specific Outcomes, CL is Cognitive Level, R for Remember, U for Understand and so on. Remember, understand, apply, analyze, evaluate and create. So R, U for Understand, AP for Apply, AN for Analyze, E for Evaluate and C for Create. Then knowledge categories, 4 general categories, factual, conceptual, procedural, metacognitive.

Then 4 engineering categories of knowledge. Then the class sessions, the number of classroom sessions devoted to that CO, laboratory sessions and our field sessions devoted to that CO. So please present them in this tabular format and we suggest that for a course that you are familiar with write all the course outcomes whether 5 or 6 or 7 whatever be the number write the course outcomes for the entire course. Thank you for sharing the results of the exercise at nat.iiscta@gmail.com.

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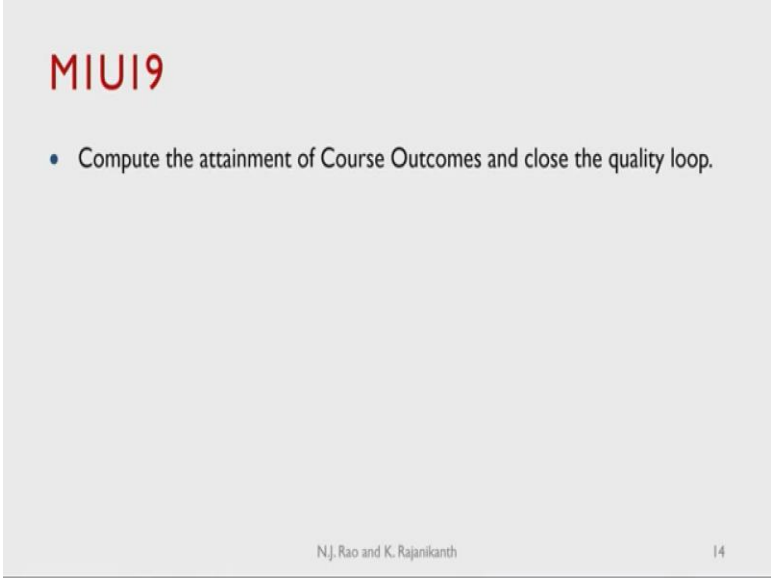

In the next unit we look at the computation of, the attainment of course outcomes and closing of the quality loop at the course level. That means we set the targets for the attainment of the course outcomes, we deliver the course, we compute the actual attainment of the course outcomes if the course outcomes are lagging behind in terms of attainment. What is the correct action to be taken?

And if the level of attainment is higher than the set targets what needs to be done? All these issues we need to discuss. So in the next unit we look at the attainment computation for the course outcomes and closing the quality loop at the course level. Thank you and we will meet with the next unit. Thank you.