Teaching and Learning in Engineering (TALE)
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Lecture - 17
Course Outcomes 2

Greetings and welcome to the Unit 17 of Module 1. This is related to our earlier activity of writing outcomes.

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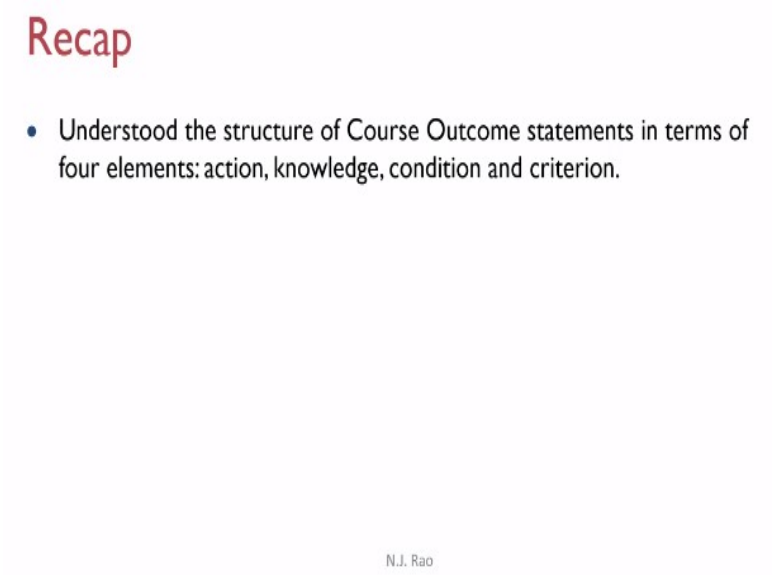

Earlier, we looked at the structure of the Course Outcome statements. The Course Outcome statement has four elements. Action, Knowledge, Condition, and Criterion. We looked at all these elements and how do you incorporate these elements into a Course Outcome.

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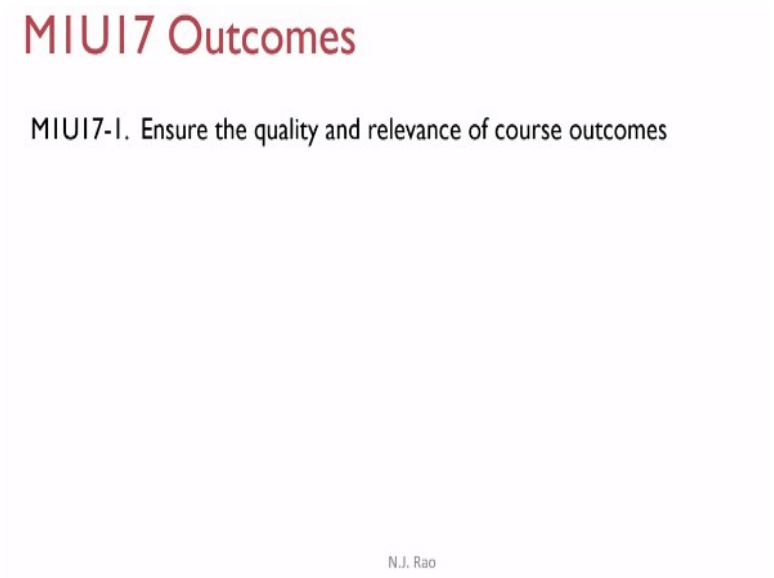

Now in this unit what we will look at is, how do you make sure that the quality and relevance of outcome statements is maintained. Towards this we will identify whole set of factors or do's and don'ts and prepare the check list so that following or in the framework of all this you can write good course outcomes.

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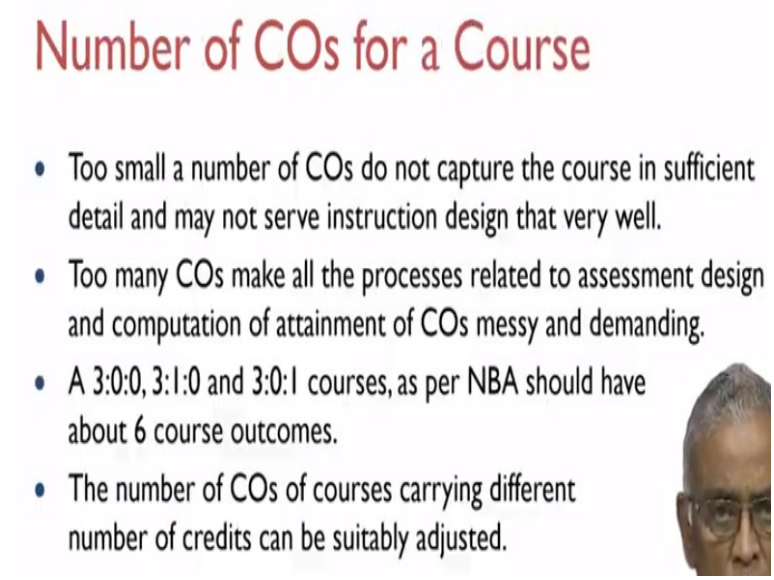

First thing is how many COs should we write for a course? Should we write very briefly? We will look at the number of COs for a course too small a number of COs we may not be able to capture in sufficient detail all aspects of the course and remember that course outcomes form the basis for actual instruction design because course outcomes are to be attained and we conduct our instruction to aiming at attainment of course outcomes in the best possible way.

So too small a number do not capture the course in sufficient detail and too many course outcomes make all the processes related to assessment design and computation of attainment of COs very messy and demanding. So we need to select the right number of COs. Most of the courses fall into these categories like 3:0:0 which means 3 lecture hours per week, no tutorial, and no laboratory. Or you may have a course 3:1:0, 3 lecture hours per week, and 1 tutorial, and no laboratory. Or you may have 3:0:1, 3 lecture hours, no tutorial, and 2 hours of laboratory session per week.

As per NBA they should have about 6 course outcomes. I would like to interpret this about 6 course outcomes as 6 + or – 2. That means you can write up to 8 outcomes. The number of COs of a course carrying different number of credits should be suitably adjusted because you can have a course 0:0:1.

That means a standalone laboratory or occasionally you may have 2:0:0 or even 4:0:0. So correspondingly for a 4 credit course you may take it up to almost maximum 10 or for a 2 credit course you can limit yourself to maximum number of 6. So depending on the credits associated with a course one has to choose the number of course outcomes that you want to write.

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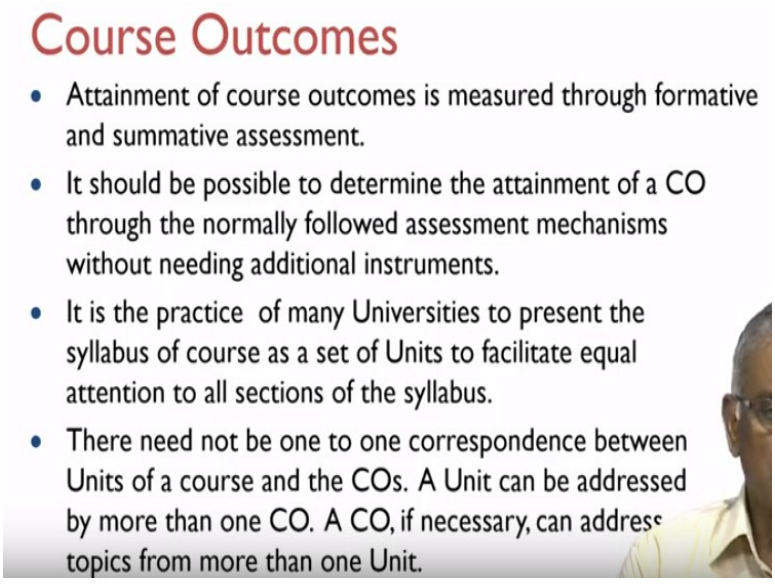

The attainment of course outcomes as we will see in a later unit is measured through formative and summative assessment because we need to have to complete the course, attainment of course outcome, what is the basis? Basis is the assessment. Assessment could be formative or summative. The summative assessment includes the End Semester Examination, Class Tests, Assignments and so on.

And formative assignment will include dominantly classroom related activities like quizzes and so on. And in addition to that one should not keep proposing very complicated way of measuring attainment and which also demands that you conduct different kinds of surveys or you conduct different type of tests to merely compute the attainment of a CO. So it should be possible to determine the attainment of a CO through the normally followed assessment mechanisms without needing additional instruments.

It is the practice of many universities to present the syllabus of a course as a set of units to facilitate equal attention to all sections of the syllabus. This has been the practice for almost last 30 years where syllabus is presented as a set of units and you essentially and then you ask the examination, the examiners to set assessment items equally of equal weightage from all the identified units.

Here we say there need not be one to one correspondence between the units of a course and the COs. Many people even today believe that you have to have one course outcome for one unit. Actually it is not necessary. A unit can be addressed by more than one CO if the content is appropriate. A CO if necessary can address topics from more than one unit.

So if you have a course with 5 units you may want to write 6, 7, 8 course outcomes to describe the course adequately where adequately means paying attention to all the details you consider important in the course.

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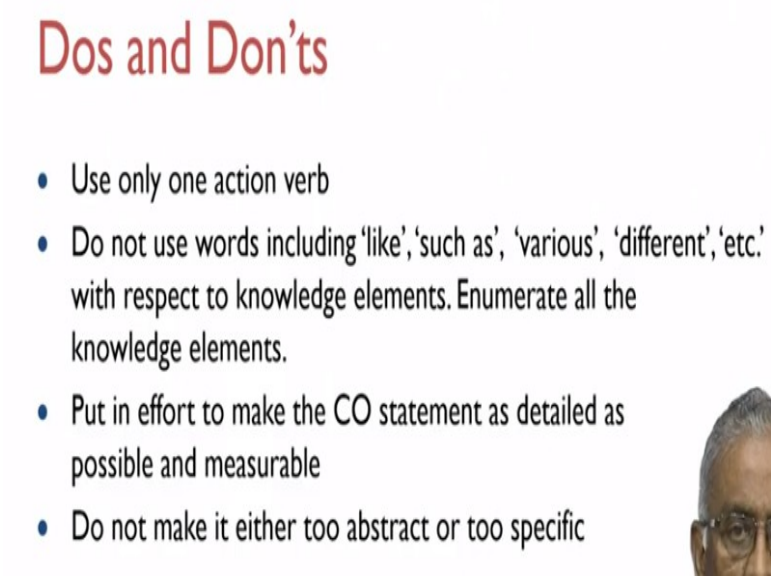

Now we want to talk about do's and don'ts. By and large, use only one action verb. Second action verb is necessary only in exceptional condition. So one action verb should be the norm. And in addition do not use words including "like, such as, various, different, etc". with respect to knowledge elements. Enumerate all the knowledge elements and as teachers we are quite used to using the words or we inadvertently also use the words various, different; like we say different aspects or various aspects and we give some examples and say such as but such phrases should not be used as a part of course outcome.

Because while "different" and "various" are very clear to the teacher if you use that word the student who is supposed to know what are all the things that he needs to learn unless they are enumerated he will not be able to. So enumerating all the knowledge elements will clarify. And sometimes the teacher feel how can we enumerate all the things.

Actually if you look at our experience, our experience shows that there may never be more than 5, 6 knowledge elements that need to be enumerated. Include all the relevant or addressed knowledge elements as a part of CO statement. And this is where it requires maybe several iterations or discussions with colleagues. Put in effort to make the CO statement as detailed as possible and measurable.

It should not be glossing over and everything is kind of implicit. The statement itself should be able to clearly communicate to the student what exactly the student is expected to do. And this can only be done through going through several iterations preferably discussing with colleagues. And finally do not make the CO statement either too abstract or too specific. Too specific sometimes will turn out to be a simply one question that you are going to ask in the topic representing the CO.

In that case, you can only ask one question. For example, whenever you write a CO, a CO represents almost anywhere from 10% of the course to almost 20 - 25% of the course. So, one should be able to ask a large number of assessment items. Should be able to design a large number of assessment items and if it is too specific you will end up stating one question.

If it is too abstract that is at a very high level if you are writing, the student will not be able to understand clearly what he is expected to learn. So these are do's and don'ts of writing a course outcome.

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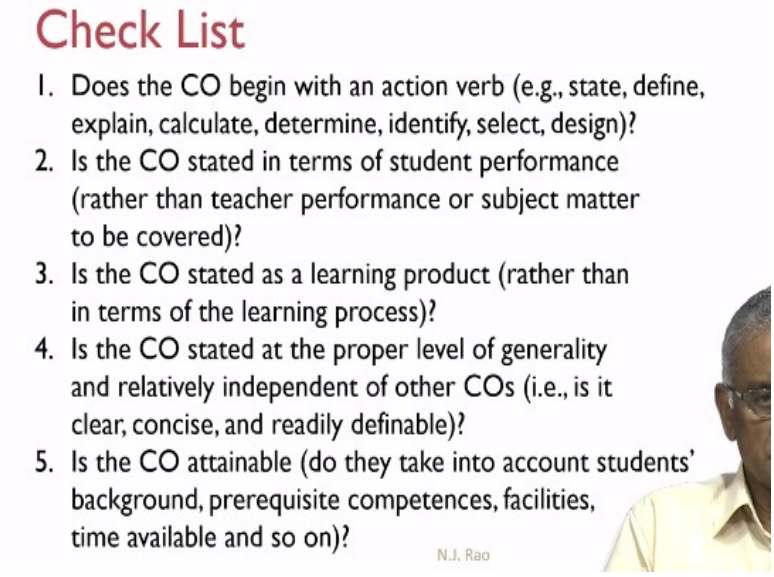

In addition, there is also a checklist. That is having written a course outcome statement you just religiously go through this checklist of 5 items. Does the CO begin with an action verb? Simple. You just have to start with an action verb. And is the CO stated in terms of student performance rather than teaching performance or subject matter to be covered. This is again a kind of a

common mistake that is done by several teachers because you look at the subject from a teacher perspective in the sense that I need to teach. Like sometimes saying the teacher should like facilitate the student to learn something.

So CO always should be stated in terms of student performance. The CO should also be stated as learning product rather than in terms of using the learning process. This is once again a common practice. First you state the learning process and then you talk about learning product. But learning product should be brought out first, should be made very clear and the learning process that means the method that you need to use or the theorem according to which you need to solve the problem. All these should come later and sometimes it can be optional. So the statement should clearly represent the learning product.

The fourth one is the CO stated at the proper level of generality and relatively independent of other COs. That means first thing is it should be independent of other CO. There should not be any overlap in terms of the content. Then it should be as we stated as the do's and don'ts it should be proper level of generality which leads to designing a large number of assessment items. And sometimes we tend to be over ambitious and we may be writing very ambitious CO statement.

So first thing is, is the CO attainable? That means do they take into account the student's background, prerequisite, competencies, the facilities available in the college and time available to address the CO. All these factors need to be taken into consideration when you write the CO statement. So this is the checklist. Again, we reemphasize that whenever you write a CO statement please check that statement with respect to these 5 items in the checklist. That way you will be avoiding some of the, what do you call inadvertent errors that one may commit.

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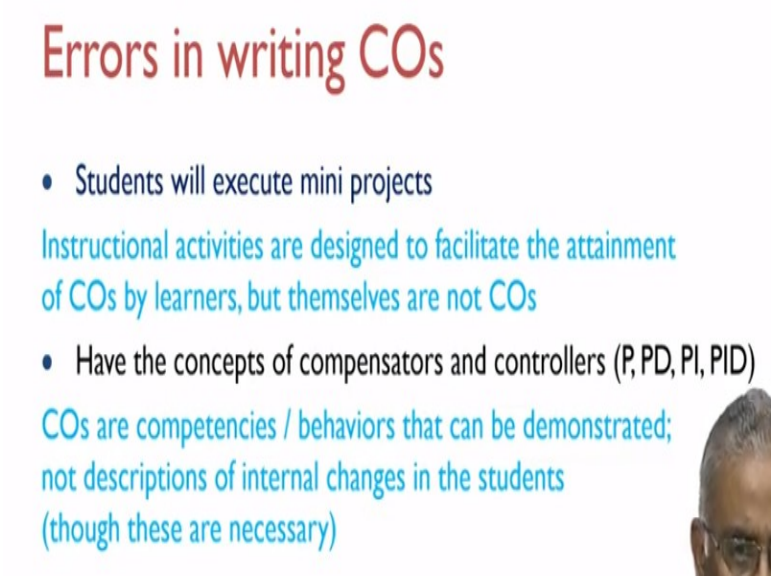

Now we will look at some of the samples. They are actually through our interactions with faculty members when we did the same exercise we collected some of the statements written by the faculty as either by Boards of Studies or by the individual faculty and let us look at some of the errors that are actually committed in writing a CO.

So one CO written was students will execute many projects. As you can see it does not start with an action verb. In addition to that what are the possible errors? Executing many projects is instructional activity. So it is only a process and not themselves - they are not - it is not a CO statement. A something needs to be attained, so this is a process statement rather than a CO statement.

Have the concepts of compensators and controllers. Controllers means P, PD, PI, PID controllers have the concepts of compensators and controllers. What does it mean? Having the concepts is an internal mechanism. Something as internal change of the student. But which cannot be directly measured. So if you have the concepts well, you should be able to perform something and that performing or the behavior should be written which can be demonstrated. Like solving a specific problem or designing a PD or PI controller in a specific context. It should be written like that rather than merely say write a statement that represents internal changes.

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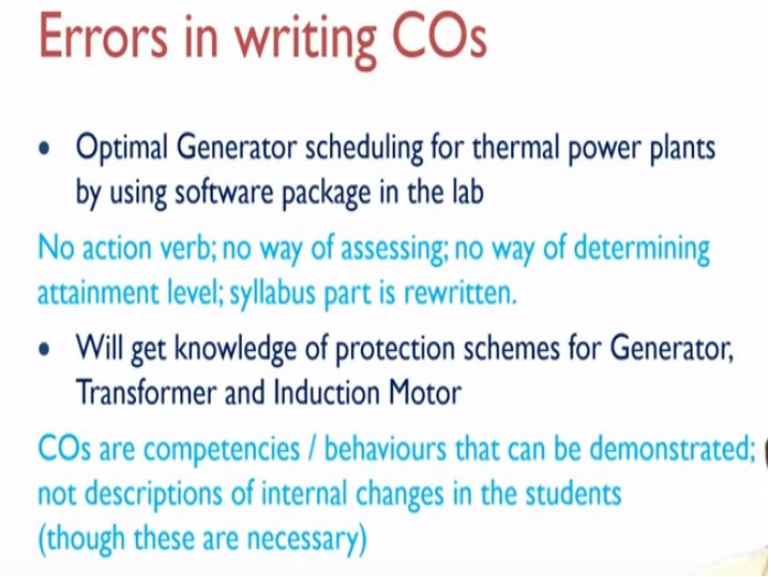

Now another one example that we pick up. Optimal generator scheduling for thermal power plants by using software package in the lab. Straightaway there is no action verb. Or it is not stated as what the student is supposed to do. As you can see it is more like what do you call part of the syllabus. In their topic list this could be there and that is picked up and written as a course outcome.

Now another CO, will get knowledge of protection schemes for generator, transformer and induction motor. Will get knowledge of protection schemes means it is internal change in a student and not a behavior that can be measured. So COs are competencies and the behaviors that can be demonstrated; not descriptions of internal changes in the students. These internal changes are obviously necessary.

But if only if you describe the internal changes that are required we will not be able to measure.

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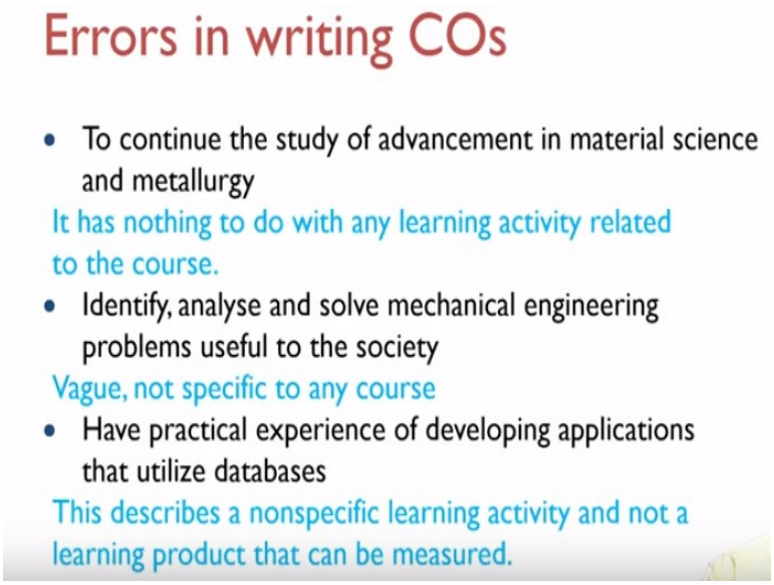

These are more interesting things. We just found a CO. To continue the study of advancement in material science and metallurgy. This is a statement that represents activities after the course is finished. You want the students who have completed a particular course to continue their studies of advancement in material science and metallurgy. It is nothing to do with a taken course. So it has nothing to do with any learning activity related to the course.

Another one - Identify, analyze, solve mechanical engineering problems useful to the society. It does not even say which course you are talking about. The earlier one was at least looking at material science. It can be any mechanical engineering course. And it says identify, analyze and solve mechanical engineering problems useful to the society. So it is vague, not specific to any course.

Have practical experience of developing applications that utilize databases. Again, it does not represent a specific activity. There is nonspecific learning activity and not a learning product that can be measured.

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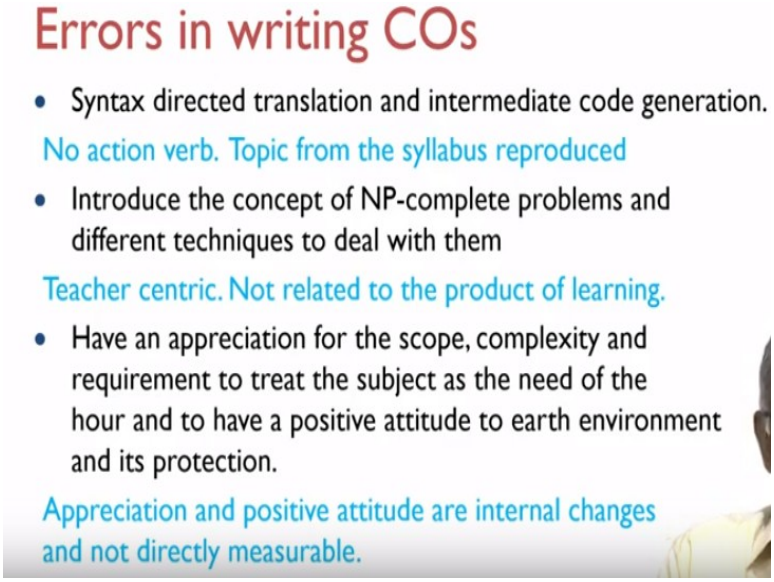

Syntax directed translation and intermediate code generation. Once again, it is a no action verb and generally sounds like topic pulled out of the syllabus. Introduce the concept of NP-complete problems and different techniques to deal with them. Who introduces the concepts? Is the teacher who introduces the concept of NP-complete problems? Which means it is a teacher centric and it is not this statement does not directly represent what the student should be able to do. So it is not a does not represent the product of learning. This is still vague.

Have an appreciation for the scope, complexity and requirement to treat the subject as the need of the hour and to have positive attitude to earth environment and its protection. Except the last phrase, earth environment and protection, the statement does not even say what exactly the student is supposed to be doing. So appreciation and positive attitude are internal changes and not directly measurable. So these are some of the errors that a teacher when especially for the first time writing outcomes for a course are likely to commit.

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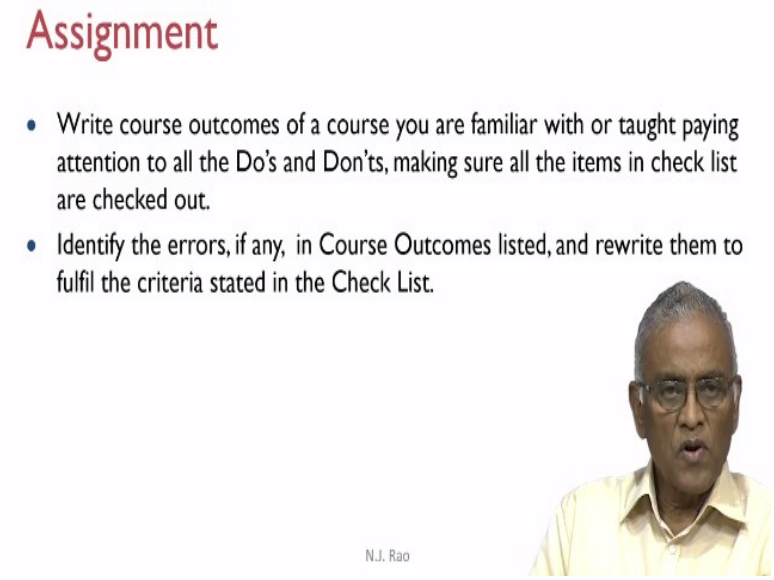

Now what we want you to do is write course outcomes of a course you are familiar with or taught paying attention to all the do's and don'ts making sure all the items in checklist are checked out. In the earlier unit you wrote some samples of course outcomes. What are the elements and how do you include them and so on. Now you have to write for a complete course making sure that all the items in the checklist are addressed to and do's and don'ts are also observed.

Again to further practice we would ask you to identify the errors if any in course outcomes listed and rewrite them to fulfil the criteria stated in the checklist. We will give you another 10 course outcomes. If they are, first of all if something is wrong with them you have to state what is wrong with them and then reword it though it may not belong to your subjects that you are familiar with. Just merely correct the sentence so that it can be pulled in as a appropriate course outcome. Let us run through these items quickly.

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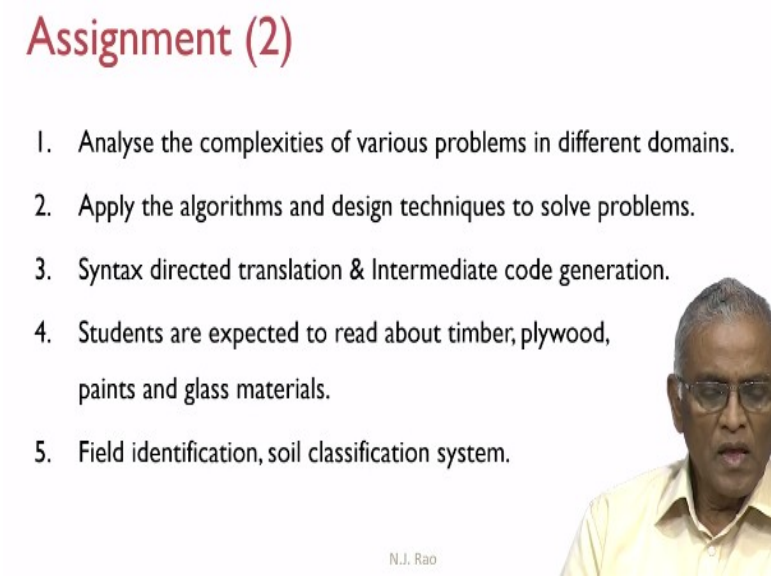

Analyze the complexities of various problems in different domains. Apply the algorithms and design techniques to solve problems. Syntax directed translation and intermediate code generation. Students are expected to read about timber, plywood, paints and glass materials. Field identification, soil classification system.

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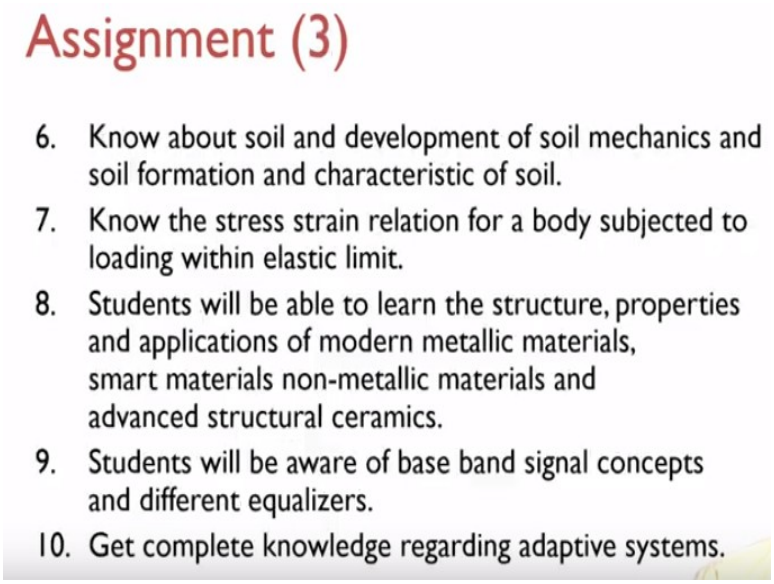

Know about soil and development of soil mechanics and soil formation and characteristics of soil. Know the stress strain relation for a body subjected to loading within elastic limit. Students will be able to learn the structure, properties and applications of modern metallic materials, smart materials, non-metallic materials and advanced structural ceramics. Students will be aware of base band signal concepts and different equalizers.

Get complete knowledge regarding adaptive systems. So these are the statements given. Please apply the do's and don'ts and use the checklist and try to identify the errors in this and reword the same.

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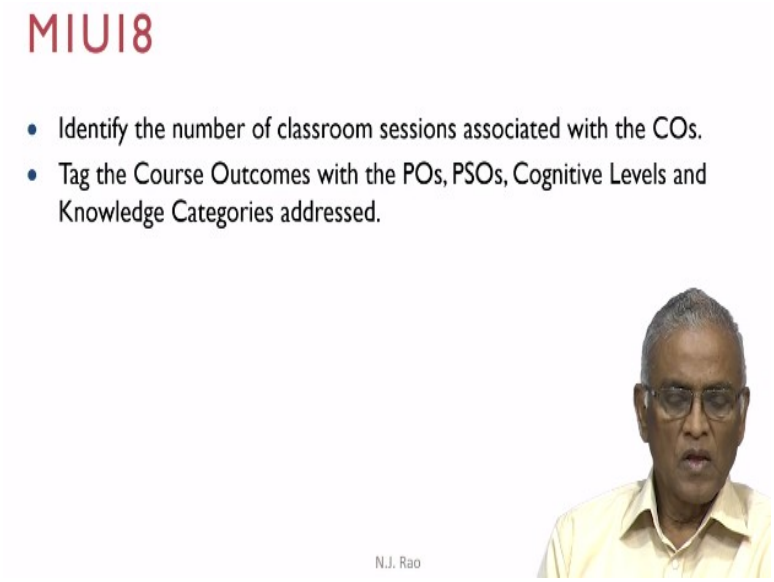

Now in the next Unit 18 we will try to identify the number of class sessions associated with COs and tag each course outcome with the POs, PSOs, cognitive levels and knowledge categories addressed. That will be the next unit. Thank you very much.