NBA Accredition and Teaching-Learning in Engineering (NATE)
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Lecture 07
POs6 9

Greetings and welcome to the first part of M I U7, which is part of NATE NBA Accreditation and Teaching and Learning and Engineering.

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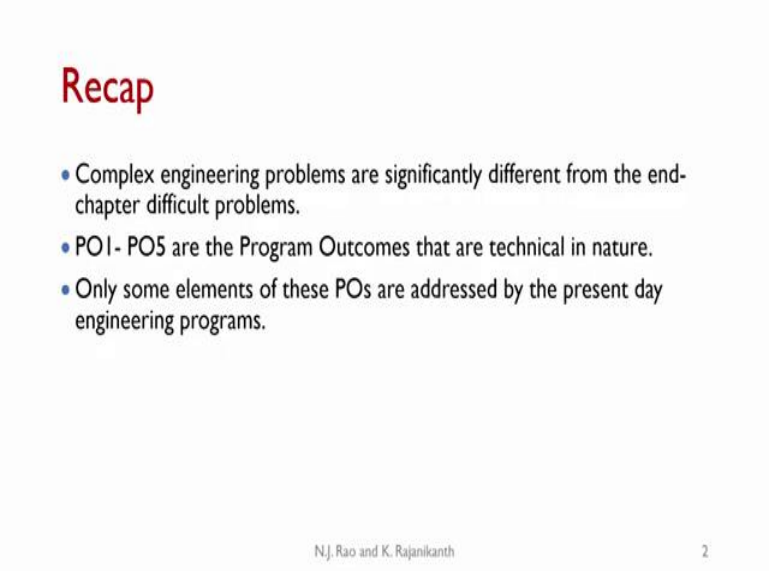

In the last unit we looked at some of the issues or the program outcomes PO1 to PO5 and there we noticed or noted complex engineering problems are significantly different from the end chapter difficult problems. One should not interpret a difficult problem from the end of the chapter as a complex engineering problem.

And also the five program outcomes PO1 to PO5 are technical in nature. That means they are specific to or they can be interpreted in terms of the discipline that you are dealing with. And also only some elements of these POs are addressed by the present day engineering programs. That is, what should be noted that while we have these POs, only some elements of these POs are addressed by majority or practically all the present day engineering programs.

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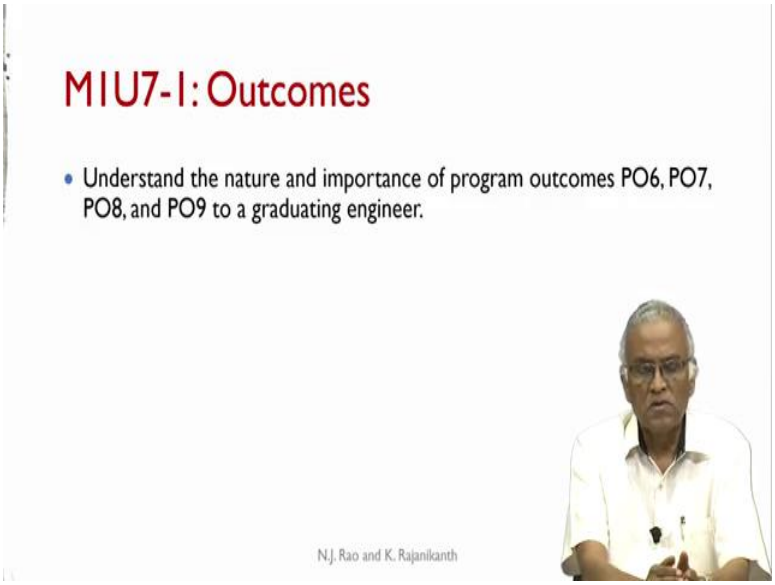

Now, we will try to look at, in the current unit, the nature and importance of program outcomes PO6 to PO9 to a graduating engineer.

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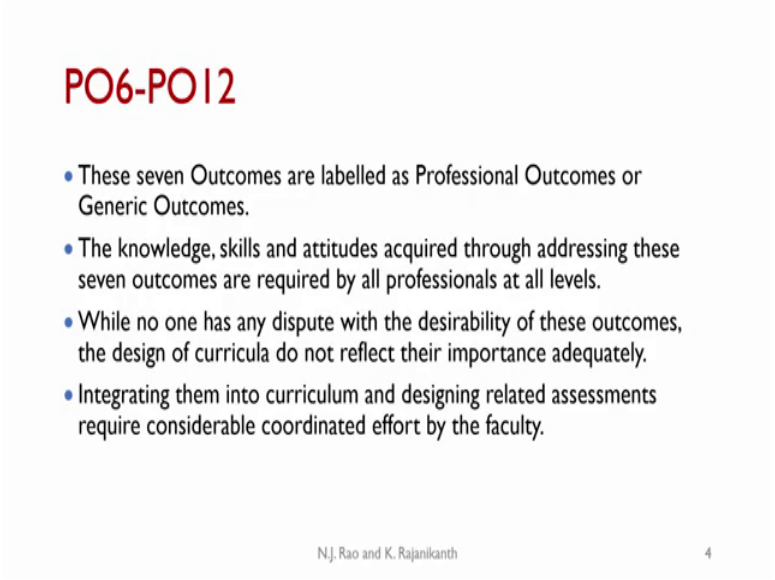

And first about PO6 to PO12, the seven program outcomes are also can be labeled as professional outcomes or generic outcomes. And the knowledge, skills and attitudes acquired through addressing the seven outcomes are required by all professionals at all levels. A good engineer requires to attain knowledge, skills and attitudes as presented in the seven outcomes.

And interestingly while no one has any dispute with the desirability of these outcomes, the curriculum design does not reflect the importance adequately. There is only limited amount

of attention, but it is kind of kept aside saying that the students will acquire on their own or after they join the company and so on. And integrating this seven outcomes into curriculum and designing related assessments is not going to be easy and requires considerable coordinated effort by the faculty.

But unless some, either the management or somewhere from the NBA insists on this. It is unlikely to get integrated into the curriculum. But before you do that a lot of effort needs to be put by several people across the country to come with the kind, the kind of exercises. How do we assess the performance of the students? And all will have to be kind of generate.

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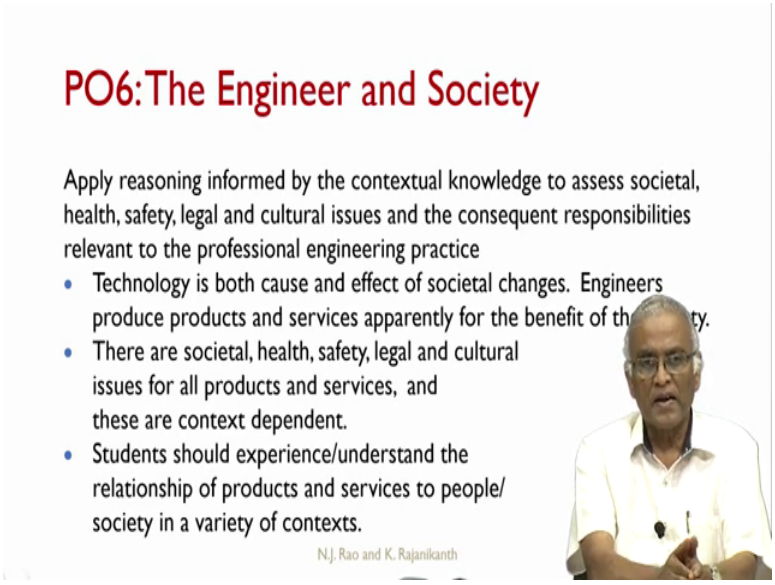

Now, let us look at start from PO 6. It is related to Engineer Society. The statement says PO 6 is, apply reasoning informed by the contextual knowledge to assess societal health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. As you can see, there are several elements to this now, engineer is providing some technical solutions to some problem of relevance to the society.

In that extent technology is both cause and effect of societal changes. There is if you take this typical example, if technology produced a cell phone, it will affect the way the society functions. And once it changes, it will also lead to, it will kind of facilitate generation of new technologies and products. So, it is both cause and effect of societal changes.

Engineers produce products and services apparently for the benefit of the society. Why we say apparently, is because he is working for a company, the company wants to make some products and sell them. And the how these products are identified, manufactured and made

available to people is if when you investigate all these stages they are not to necessarily, not all aspects are necessarily desirable.

That is why we say apparently for the benefit of this society. There are societal health, safety, legal and cultural issues for all products and services. And these are context dependent. And here students should experience or understand the relationship between products and services to people or society in a variety of contexts, at least this is the exposure the students should get through some specific case studies.

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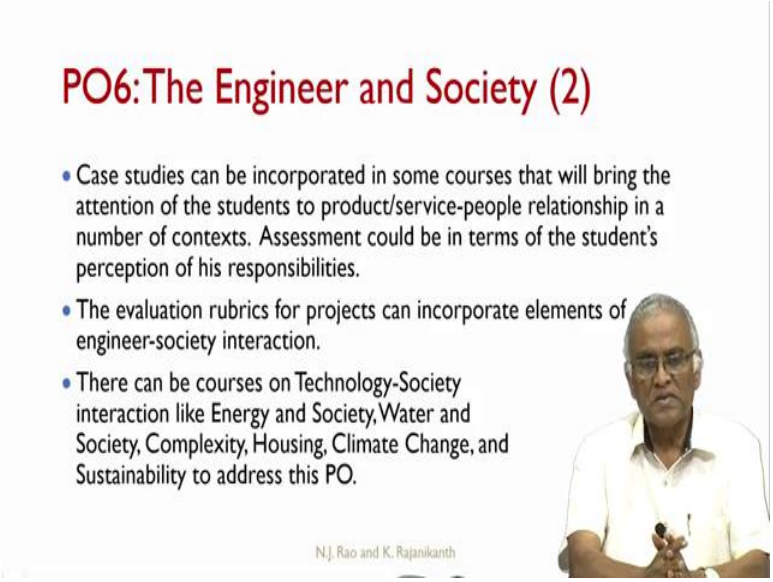

So, case studies can be incorporated in some courses that will bring the attention of the student to product service people relationship in a number of contexts. And assessment in that kind of case study could be in terms of the student's perception of his responsibilities. And if the evaluation rubrics for projects can incorporate elements of engineer society interaction. For example, the students can be encouraged while doing their project to look at the issues of the products and Society interaction, whatever project or product that is trying to develop, and it is the interaction with the society at least you can explore.

I am still a better way in my opinion is to design a few courses. Not all courses can be given obviously, choose from a list of these courses that will directly address the interaction between technology and society. This could be energy and society, water and society, complexity, housing, climate change, and sustainability to address this particular PO, at least one course in a program can focus the attention of the student on the technology, society interaction.

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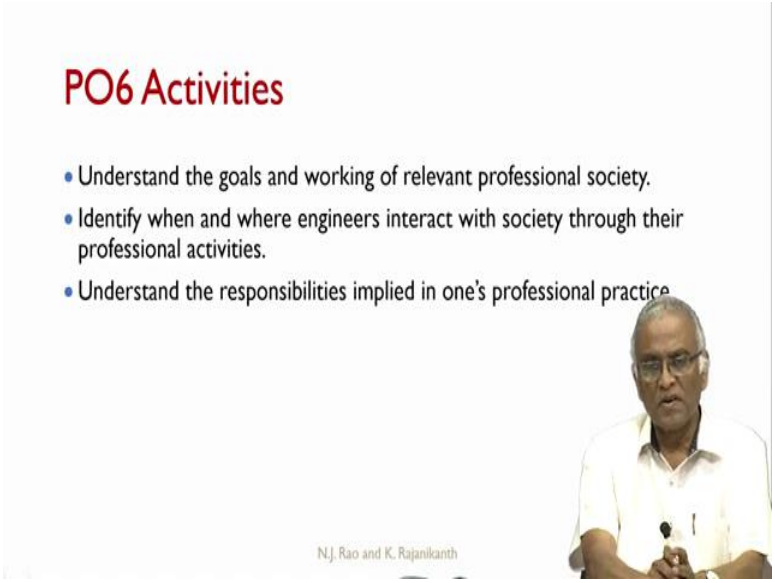

And what are the activities we can have for PO6: Understand the goals and working of relevant professional society, identify when and where engineers interact with society through their professional activities, understand the responsibilities implied in one's professional practice. So, some material can be prepared under this and can be presented to the students so that they can understand all these elements.

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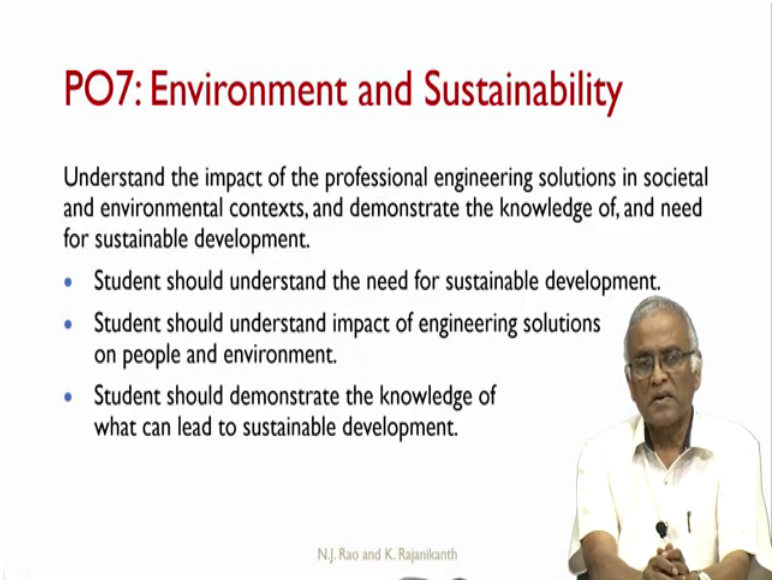

PO7 is related to environment and sustainability. The statement says understand the impact of the professional engineering solutions in societal and environmental context and demonstrate the knowledge of and need for sustainable development. So, there are two issues, one is environment, the other is sustainability.

So, first thing is students should understand the need for sustainable development. There is enough amount of literature available about this, but the issue is where exactly do you incorporate this material? Do you want to give a course on this or should it be part of something else, that decision will have to be made by the designers of the curriculum.

And students should understand the impact of engineering solutions on people and environment. For example, all of us are now facing the, the convenience of plastic products, which are only used once on the environment is known to everyone now. That is why the country is bringing legislation to ban the one use plastic products. And it is not that very easy because they are convenient solutions to find alternatives is going to take time, but also likely to be more expensive and students should demonstrate the knowledge, what can lead to sustainable development.

We will not talk about at this stage the what is sustainability? And what are the features of that? But in a resource limited environment and also what we call thermodynamically closed system like Earth and sustainable development is going to be very, very complicated. And we are going to be all of us are going to be part of it. So, an engineer should certainly understand what is what is involved in sustainable development?

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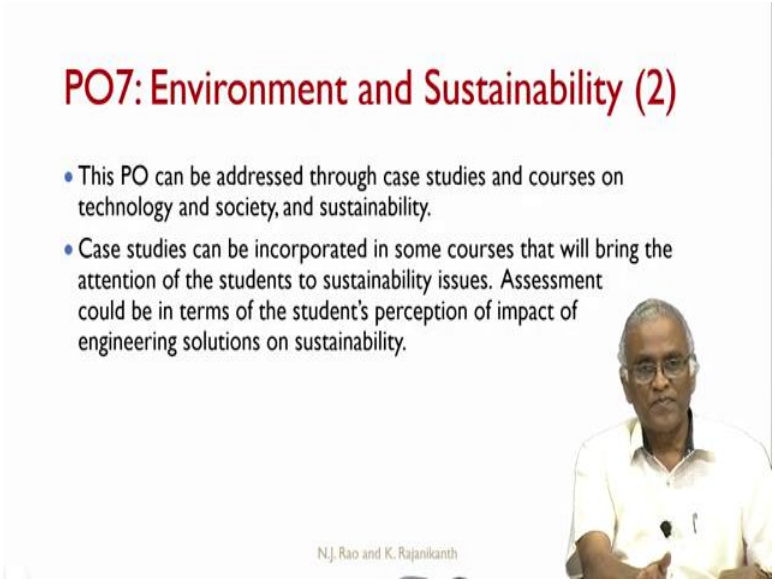

This PO can be addressed through case studies and courses on technology and society and sustainability. So, to that extent PO6 and PO7 can be addressed together through specially designed courses. Our case studies can be incorporated in some courses that will bring the

attention of the students to sustainability issues. And when you incorporate assessment could be in terms of the student's perception of impact of engineering solutions on sustainability.

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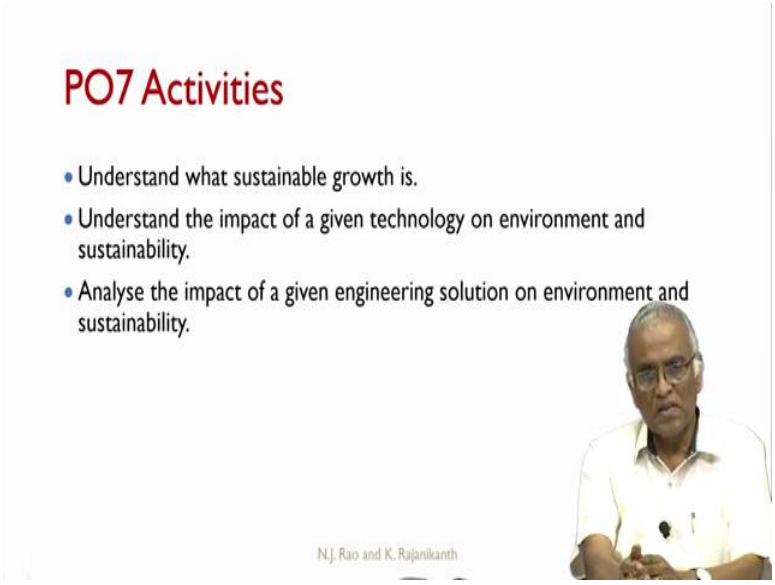

What are the activities that you can use understand what sustainable growth is? Understand the impact of given technology and environment and sustainability, analyze the impact of a given engineering solution on environment and sustainability.

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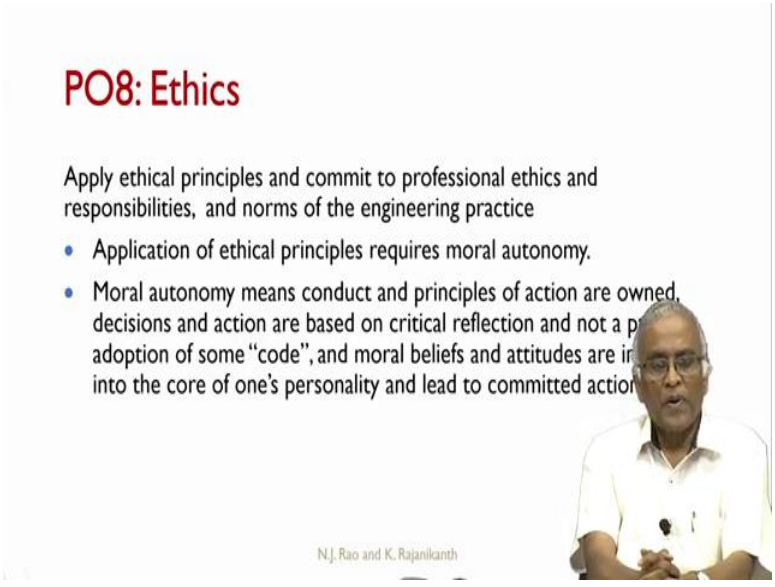

Now PO8 is ethics apply ethical principles to commit to professional ethics and responsibilities and norms of engineering practice. This also is not very easy, but not that very difficult. But first of all, one needs to understand what do you mean by application of

ethical principles? What does it require? It requires moral autonomy. What is moral autonomy? Moral autonomy means conduct and principles of action are owned. There is any decision that an engineer is taking, you have to own the decision.

Decisions and actions are based on critical reflection and not passive adoption of some code, your boss tells you, you have to follow this procedure. Then you say I do not know anything about it, I was asked to follow. So, if there is any negative impact or negative things about it is all, it all should go to the boss. And moral beliefs and attitudes are integrated into the core of one's personality and lead to committed action. That is what moral autonomy means. It is not going to be easy. You have to own your decisions.

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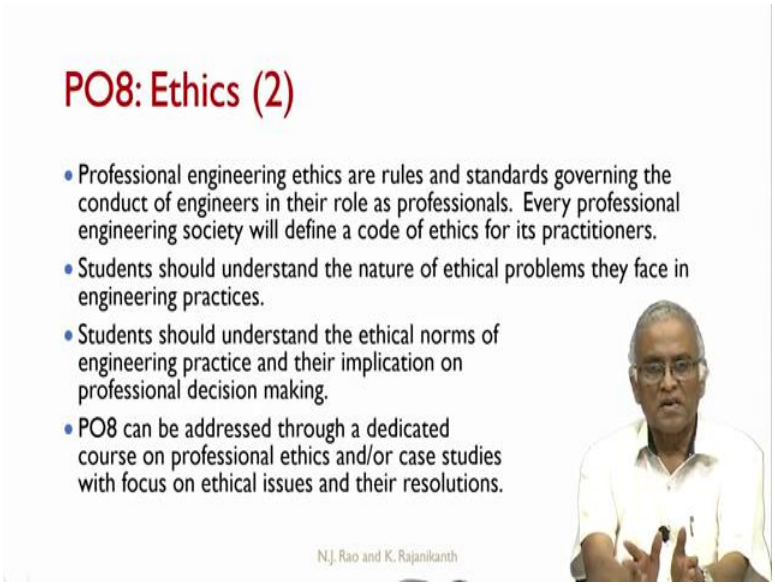

And these decisions should be based on what you call your critically evaluating all the issues related to a particular issue. Now, professionally engineering ethics or rules and standards governing the conduct of engineer in the role as professionals. For example, in every role that you play, there may be some standard professional practices. So, the minimum requirement is to follow those practices. Normally every professional engineering society will define a code of ethics for its practitioners.

And first thing is you should understand the nature of ethical problems a, an engineer faces in their practice. And students should also understand the ethical norms of engineering practice and their implication in professional decision making. PO8 can be addressed through dedicated course on professional ethics and or case studies that focus on ethical issues and their resolutions.

For example, there are courses, there have been courses designed and some engineering programs have actually incorporated a course called professional ethics, which is a course can be very general about engineering or the professional ethics course can be related to the particular discipline. If for example, if you take Computer Science and Engineering, there can be quote professional ethics course related to computer science and engineering, such courses have been designed and offered. And if the curriculum designers will have to make a decision regarding how to how one, one is going to address this particular PO8.

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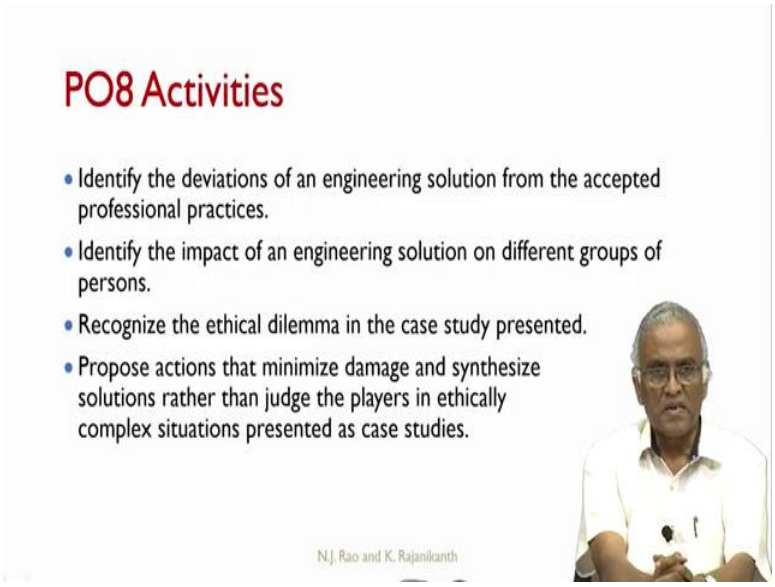

So, some of the activities to address PO8 identify the deviations of an engineering solution from the accepted professional practices. You can consider take a case of a solution already created and compare it with the accepted professional practice and identify the deviations in that is only a net appear on paper level. Identify the impact of an engineering solution on different groups of persons. Recognize the ethical dilemma in the case study presented.

If you take any issues related to disputes over water, you will find any number of such ethical dilemmas. Propose actions that minimize damage and synthesize solutions rather than judge the players in ethically complex situations presented as case studies. Ethical behavior does not necessarily mean that you kind of judge the people involved in that. It also requires to you to understand why people behave in one particular way in a given situation. And such issues can be presented as case studies.

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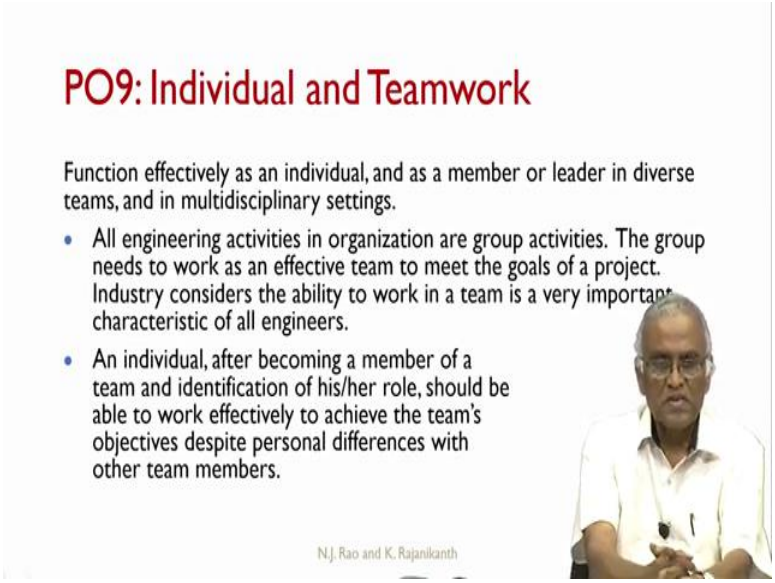

Now, this one is easy to handle not that easy when implemented. PO9 is related to individual and teamwork. So, function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings. There are several issues here that need to be looked at. One is you should function effectively as an individual, that is easy to understand. And then as a member of a team and this team could be, you could be a member of different types of teams.

Because from one project to the other, when an engineer moves, the nature of the team will can be completely different. That is why diverse teams and also in multidisciplinary settings, there are just too many aspects to this. First thing is all engineering activities in any organization are group activities. There is nothing like one individual working on a project, when you join after your graduation in any organization.

The group needs to work as an effective team to meet the goals of the project. Industry considers the ability to work in a team is a very important characteristic of all engineers. If you rank order the characteristics, assuming that you are already graduate, the first and second one is ability to work as work as a member of a team and the ability to communicate, these are the two most important characteristics considered by the industry.

So, an individual after becoming a member of a team, and identification of his or her role, should be able to work effectively to achieve the team's objectives, despite personal differences that with the other team members. So, for the team to be effective, you cannot an individual cannot keep bringing the personal differences onto the table all the time, that will

completely make the team ineffective. So if one is to be a good team member, he should be able to separate out individual personal differences and the activities related to the project.

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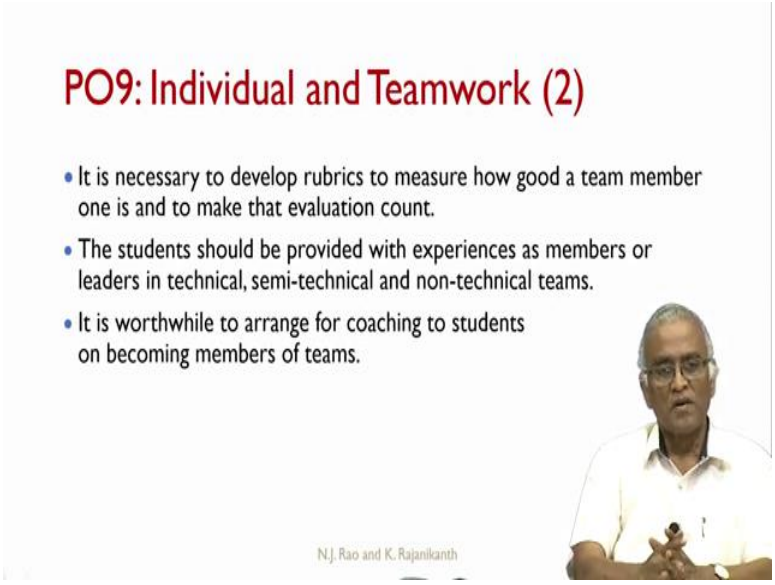

Of course, it is not very easy. But if you want to be a good team member, one has to learn that. It is necessary to develop rubrics to measure how good a team member one is and to make that evaluation count. There are rubrics available, which are developed by HR teams for that kind of thing. And they can be brought into the kind of learning experiences the teacher can create, to facilitate the student to become a an effective team member.

Students should be provided with experiences as members or leaders in technical semi technical and non technical teams. So, it is worthwhile to arrange for coaching to students and becoming members of teams. Somewhere, if the college or department can arrange some amount of coaching to the students, hopefully the students would become better members of teams.

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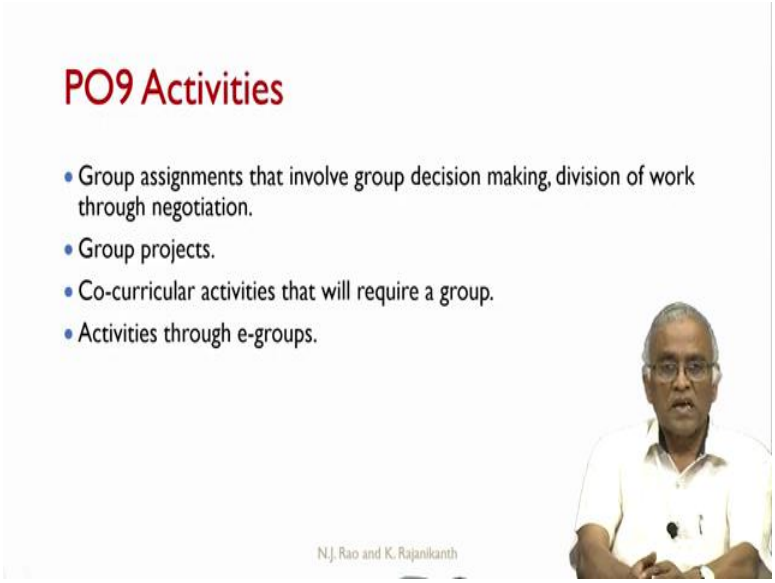

What are the activities you can have group assignments that involve group decision making, division of work through negotiation. If you can do that, group projects, co-curricular activities that will require a group. Activities through e-groups, these days, you form a group on the internet rather than face to face activity. So, activities through e-groups can also be one of the activities to address the PO9.

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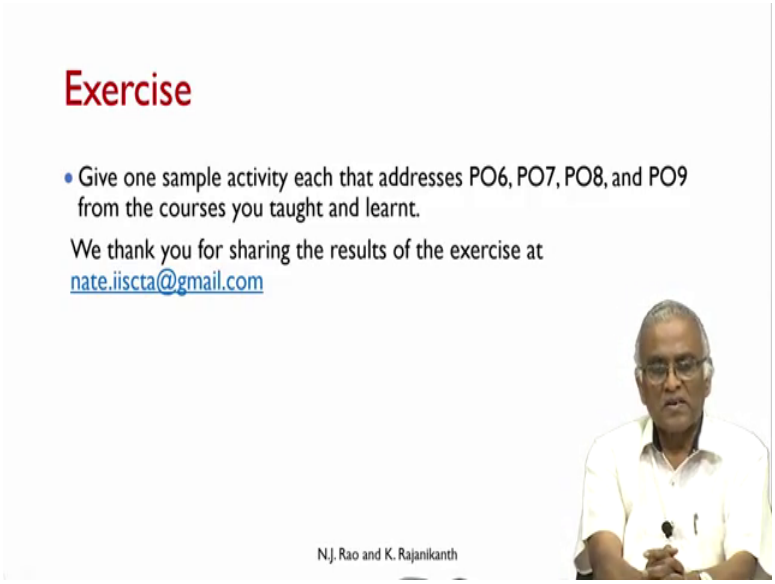

So, we will request you to give one example activity that addresses PO6, PO7, PO8, and PO9 from the courses you taught and learned in whatever manner that you, you can identify that sample activity. Will thank you for sharing the results of the exercise at this.

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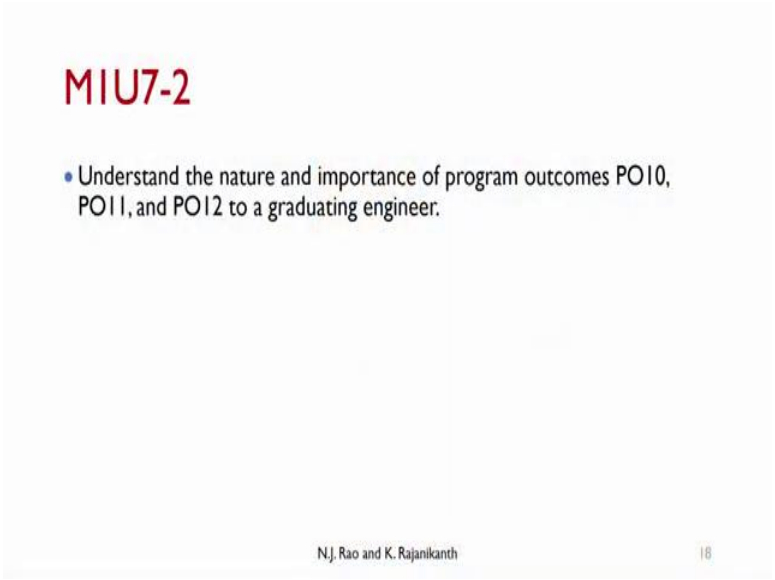

And now, in the next one that is M1U7 what we call part two, we will be looking at the remaining three program outcomes PO10, 11 and 12 and their importance to a graduating engineer. And thank you very much.