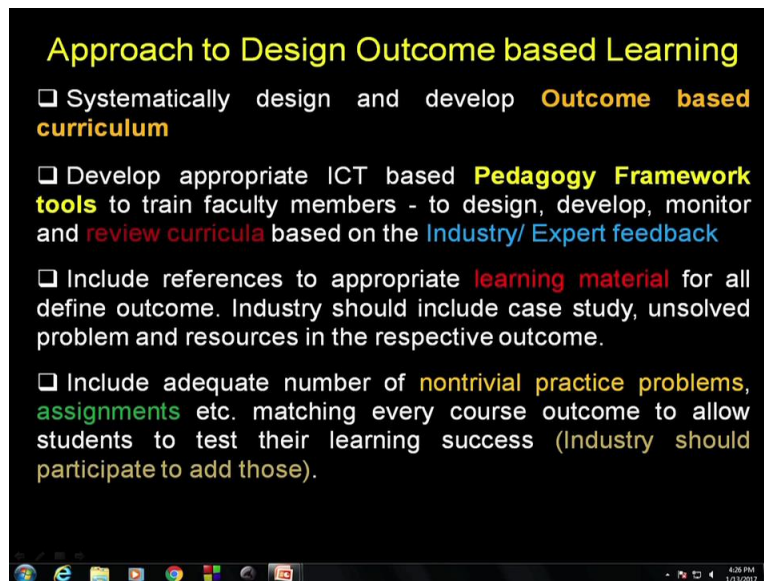


Outcome based Pedagogic Principles for Effective Teaching
Professor Shyamal Kumar Das Mandal
Center for Educational Technology
Indian Institute of Technology Kharagpur
Lecture 04
Approach to Design Outcome based Learning

Okay so last class we have discussed about that outcome based framework and that mission vision program educational objective, then teaching learning process all kind of things.

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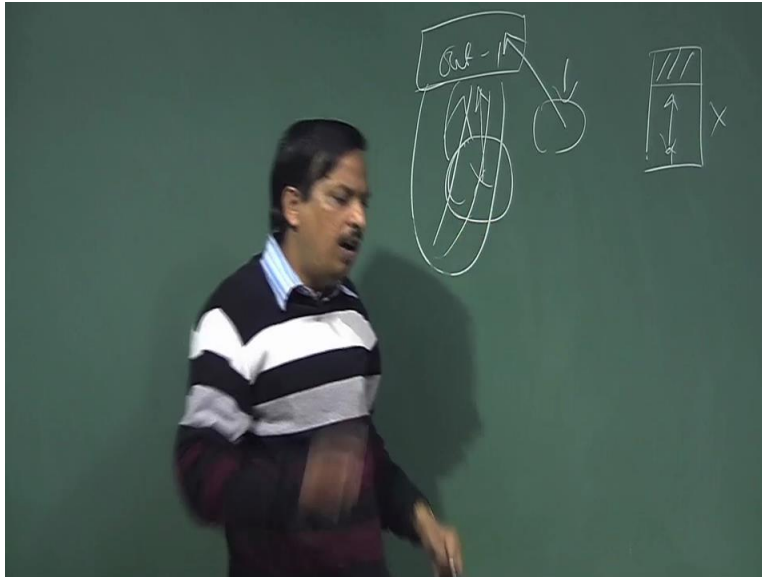
Today let us start to discuss about approach to design outcome based learning. What should be the approach we should take to design outcome based learning? First one systematically design and develop outcome based curriculum which is very important. Systematically develop the outcome based curriculum all details I will cover.

Then develop appropriate ICT based pedagogy framework tools. Why I said the pedagogy framework tools because if I said I I developed a outcome based curriculum and submit to NBA or something and I not share with the students and also only develop the top level of the outcome based curriculum not the bottom level. I will come what do you mean by bottom level?

Then what will happen that the pedagogy which I want to follow in outcome based pedagogy is not effective. It is not effective. So what I will do lets develop a tool or framework which can allow to share to design, develop, monitor and review the outcome based curriculum based on

my industry expert, based on the domain expert, based on the students. So everybody take a part in the curriculum design and also the curriculum is readily available to every students before they come to the class, okay. Include reference to appropriate learning material.

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Now I said I define a outcome lets I define outcome one okay. I define outcome one but unless I provide the appropriate learn learning material to related to outcome one then how do I promote the self-learning. So if I want to promote the self-learning, I said define the goal outcome is the goal, define the path, the resources of the path and define a test item by which a student can test whether he achieve the goal or not?

So include reference to appropriate learning material for all define outcome. Industry should include case study, unsolved problem and resources in the respective outcome. Include adequate number of assignment, practice problem in assignment so that student can test whether he achieve this outcomes or not? So we are not saying thus simply design the outcome based curriculum and keep it secret with the teachers or somebody else.

But not publish in the to the students. We are not saying that. We are saying design a structured curricula not only based on outcome but also for every outcome include the learning material. Different kinds of learning material you can includes and include the test item so that the students can follow their own path. I will come later on it.

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Outline of a Outcome based approach

Important Steps

- Choose **Appropriate, Challenging but Achievable** Specific Learning Outcome
- Write them down in **clear and measurable terms** using **standard action verbs**
- Prepare **study guides / learning strategies** with detailed list of learning resources
- Make it **available** early to all concerned

Cont...

Lets what will be the approach? The approach is outline of this approach. That choose appropriate, challenging but achievable specific outcome. So that go to the faster, lets I take a subject. A subject A, I define the appropriate what I said appropriate challenging but achievable outcome I defined. Then this outcome, how to I write this outcome? It not that easy.

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It has to be written with clear, measurable term and standard action hub using bloom taxonomy. So all bloom taxonomy and his structural system design will be later on taught but every

outcome must follow that. Every outcome must be achievable, measurable and challenging and how to write the outcome using Bloom's taxonomy and his structural system design.

Once I write that outcome a student knows where I have to go. What will be given? What skill I have to perform up to what level? That is define. So students know that make it available to the students then prepare learning material to achieve this goal. There will be learning material, prepare the learning material to achieve this goal.

There will be different kinds of learning material. Some may be text book, some may be paper, some may be animation, some may be NPTEL video, some may be Khan Academy video, some may be something else. So all kinds of learning material which scatter to the outcome achieve this outcome will be defined by the teachers and this can be modified by the industry can add, industry can modify the resources and add relevant resources. Some domain expert can also add resources and so it is involved in process.

Once I do that, what I am covering is that, if I have a large class. Four hundred student class. Every student is not following the same learning style and same learning capability also learning approaches. Some students are surface learner, some are deep learner, some are very ordinary students. So now outcome is given, material is given, test item is given. Now every student can follow its own path to achieve the goal but everybody has to achieve the goal.

So brilliant students may go through the difficult module, difficult text books and some other difficult text and quickly achieve this outcome but slow learner who are not that much of intelligent but they know I have to achieve this goal. So I can follow, take their own space and follow the him here.

So it increase the student engagement. If I am students I know I have to reach this goal and throughout the semester I have to reach this goal and if this goal reaching this goal required lets study some engagement time without attending spending this engagement time I cannot reach this goal. So it is increase the student engagement. So systematically I have to design this thing.

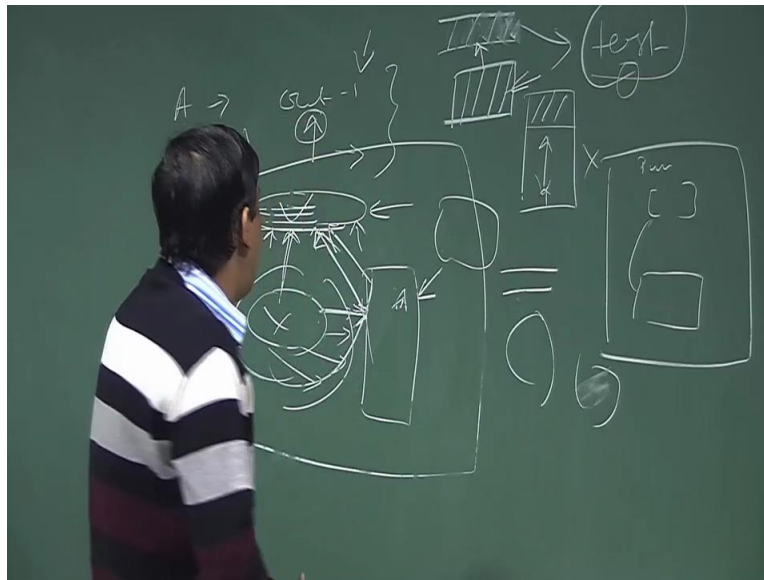
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- ▣ **Reduce lecture hours and increase tutorial hours to :**
 - **Discuss unsolved problems.**
 - **Conduct formative evaluations .**
 - **Provide individual feedback.**
 - **Allow more time for students to learn**
- ▣ **Promote use of active learning through simulation tools, virtual labs and also game based learning.**
- ▣ **Design courses to promote collaboration, communication and problem solving.**

- ▣ **Develop adequate self assessment material well matched with learning objectives to allow students monitor their progress and seek timely help.**
 - ▣ **Provide suitable technology tools which allow**
 - **Students access to learning resources, interact effectively with peers and mentors.**
 - **Faculty to monitor progress, evaluate and provide timely remedial lessons.**
 - **External experts / industry to participate.**
- Cont...

Now I have already discuss that if you see develop suitable that the test item. I always slide also explaining the same thing. So what I have explained and then next I go to here. I am favor of reducing the lecture hour. So once you design this kind of document, I will show you how to design this kind of document and readily available to the students.

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Once you design this kind of document, the goal is available material is there, test item is there then I do not have to deliver this material in the class because I share lets I say the student will able to design a push pull amplifier of this kind of specification. This goal is there and corresponding material for designing push pull amplifier is available that will here. So I do not have to deliver the same material in the form of lectures.

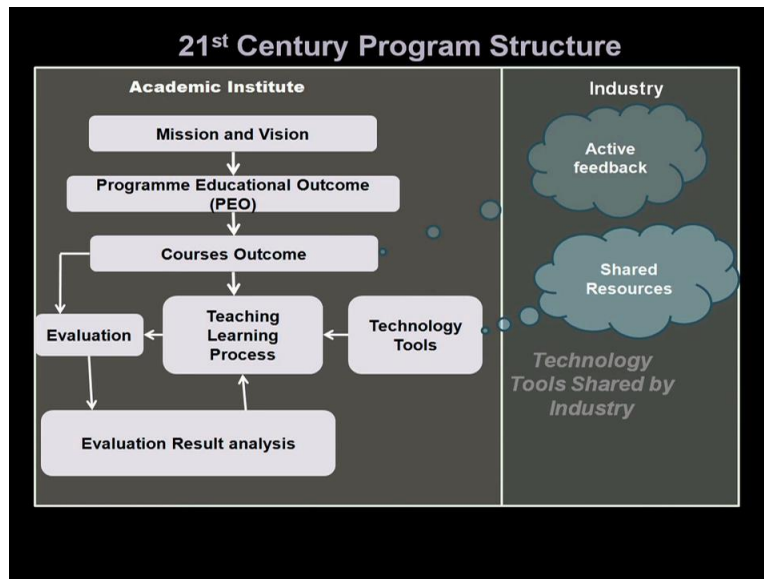
What I will do, I told the students lets today's class this is the objective of this class, outcome of this class and those of the material. If you follow this material you can achieve this outcome. So what this may be a video lecture of your previous recorded video lecture. This can be a reference material. This can be a Khan Academy video. This can be a NPTEL video, does not matter but as a teacher I specify if a student follow this material he can achieve this outcome.

Then I told the students, lets you through this material and came prepare with my class. I will test whether you achieve this objective or not? Once the student is come in the class, lets take a test item of this to test whether the student is active or not? And told the students are you able to solve this kind of test item? If they say no then discuss where is their miss conception? So discuss unsolved problem. Conduct formative evaluation to check whether the student achieve the goal or not?

Provide individual feedback. Yes it is possible, once you define the goal and material and test item then the problem misconception to related to the achieving this goal will be (10:06) to certain misconception. So different student may have different misconception but if I have four hundred student there should not be a four hundred misconception. So they will be cluster together. Now in the class I will discuss only those misconception, which is come out.

Most of the time (10:25) find the misconception will be solve by the student itself. Very few cases teacher has to be intervene and explain the misconception what our the student is there. So it promote active learning. It promote student engagement. It promote self-learning. So once I design systematically design this whole material then its promote the self learning. Other way even today most of the institute are required to fill up the NBA document. So once this is available for every course fill up in the NBA document is very easy.

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I will discuss, lets typically NBA documents has initially if you see that mission and vision statement then PEO then so, I here I have one things is miss. One is mission and vision statement, then PEO then PEO related to PEO PSO program specific objective which related to PEO. PEO of NBA. NBA PEO as per the NBP PEO attributes program specific objective is return down and top is program educational objective or outcome and then each course continuation course outcome continuation will come.

So we are not we are not restricted to course outcome. We shade to develop this course outcome along with a simple structures, which I will mention later on. If this structure is available give it to the students before they come to the class its promote the self-learning. So effective teaching in here and if you done this thing designing that NBA document will become very easy. So let us spend some time on what is the meaning of mission and vision statement PEO.

It will help to develop the NBA documents but the purpose of this course is not to that help you to provide develop the NBA NBA documents. The purpose of this course is to what kind of teaching learning process we should follow, so that teaching become effective okay. So now discuss on that issue mission and vision statement. Everybody know what is mission and what is vision.

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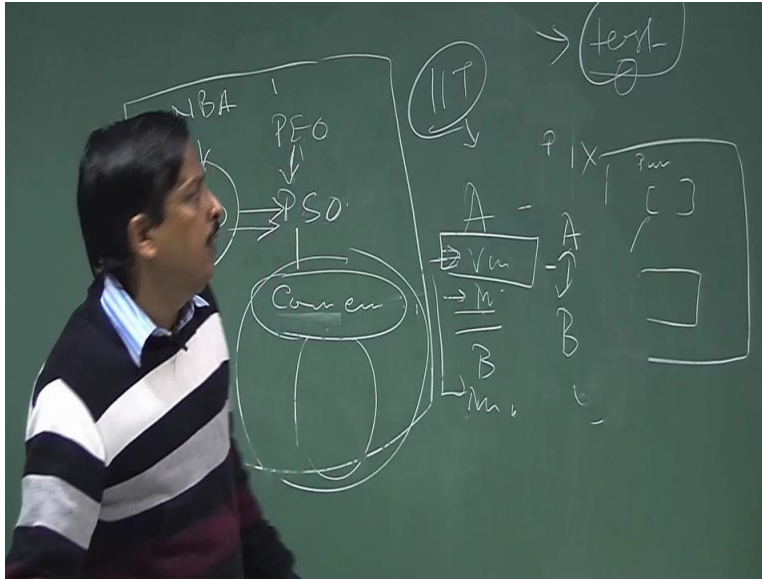
Vision and Mission Statements

Vision Statements

- ***Vision is a futuristic statement that the institution / department would like to achieve over a long period of time***
- ***Example 1: Vision: Create high-quality engineering professionals***
- ***Example 2: Vision: ---To be a premier university that propagates the generation and dissemination of knowledge in cutting edge technologies***

Vision is a futuristic statement that institute department would like to achieve over a long period of time. Every institute, every colleges or you can say every dep lets the department also a vision and mission.

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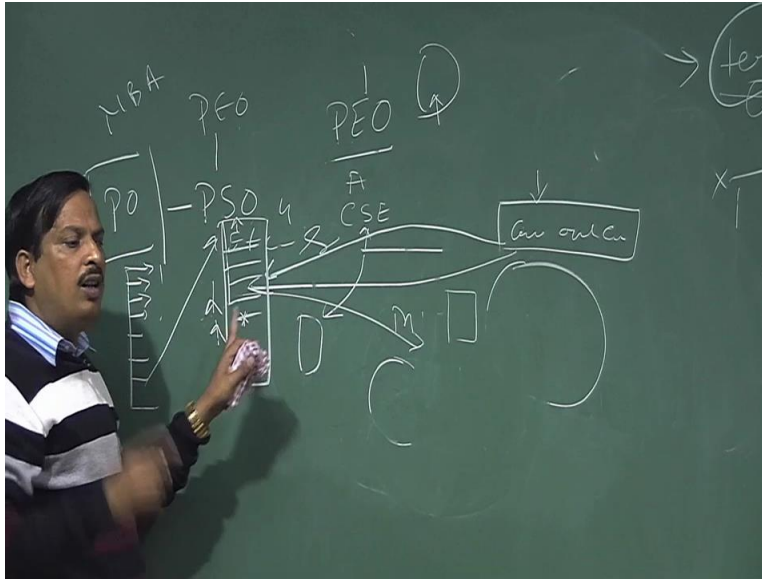


So let us institute A has a vision and institute A has mission. So mission is the means to fulfill the vision and vision is a futuristic statement that institute department will like to achieve over a long period of time. So institute A mission and vision. I can write down institute B mission and vision.

It may not be same mission of institute A, mission of institute B may not be same that's that so mission statement depending on the requirement that what kinds of quality students institute A want to produce. Unless you can say why required different syllabus I can follow the IIT. If the IIT syllabus is the better syllabus, I can follow the IIT syllabus to the every engineering colleges but why the syllabus is different because the purpose of the institute to create a institute, the purpose of the institute is different from the different institute.

IIT mission and vision is different from any other institute or let institute A mission and vision, institute B mission and visions is totally different. So based on the mission and vision statement, what I have to created? I have to created program educational objective who fulfill the mission and vision statement of the institute. Different program so program educational objective or program educational outcome PEO will be depends on the mission and vision statement of the institute.

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So PEO, PEO program educational objective or outcome here objective means instructional objective which is basic basically a outcome of that program. So program educational outcome will be different computer science program CSE of institute A and computer science program, four year computer science program of institute B will be different because this institute my produce the student to supply to local industry. This institute may produce the student to do higher research.

It is based on his input and what kind of facility he has and that kind of program education objective is written. So program educational objective directly related to mission vision statement of the institute and PEO will be different from institute to institute. So PEO somebody said okay, lets write the PEO of suppose I copy the MIT PEO. What about the PEO is write by the MIT? If I copy then is there my program will be better? No because I do not have that facility. So depending on that whether I will this PEO is achievable or not.

So achievable term is available, PEO should be achievable. So depending on my infrastructure, depending on my resources I will create my mission and vision statement and PEO. Then you may say okay I will create PEO very (16:56) PEO, but once you write down the PEO it quantify, what is the minimum requirement? Then NBA said this PEO does not quantify the minimum requirement so you have to change the program.

So PEO minimum requirement PEO can be different level depending on institute. You can say infrastructure, facility, input input student intake student all kinds of parameter will be varies.

Once I write down the PEO, I have to write down the program outcome. What I said that PEO related to the P program specific outcome which is followed the program outcome of NBA program outcome of NBA.

What is the program outcome? Twelve graduated attributes if it is graduate program then twelve graduate if attributes one, two, three, four in case of NBA. So those NBA once I write down to the electronics department specific lets for four year program on electronics and telecommunication then its becomes PSO program specific outcome.

Once I define the program specific outcome that define me what kind of subject I should offer to achieve this program specific outcome. This is the scientific aspect of designing the curriculum. Now people will say how we do design this kind of curriculum. In my opinion lets you design the course outcome clearly and course structure. So once course outcome not only reflect that what I have taught in the course.

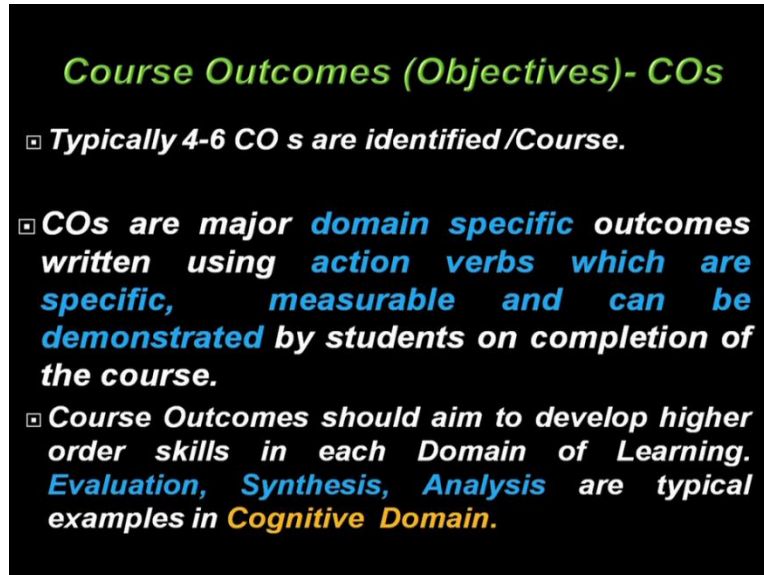
Course outcome along with the course structured. I will mention, what is the course structure will reflect, what kind of teaching learning procedure I will follow and what should be the course outcome? I have already mention the course outcome can meets certain PEO directly and certain PEO parameter can be meet by the how teaching learning process of that course. So both teaching learning process and course outcome is important to match with the program specific objective okay.

So program, outcome program once I write that program outcome for electronics then it is becomes PSO program specific outcome. Once I define the program specific outcome for each for I have to I have to achieve all outcome. So to achieving all outcome I have to offer different courses. So it may be interactive process.

I define my program outcome then select the courses available in outcome based course is available then I can select automatically which course meet my PEO or I can define (())(20:10) PEO given to the teachers, that this I my PEO. Lets write down the course and course should map with this PEO and I can match with the PEO and after matching algorithm I will found that

this this outcome is not matching then I can change the course course outcome to match this PEO. I will come how this program matrix and (())(20:33) those things I will come.

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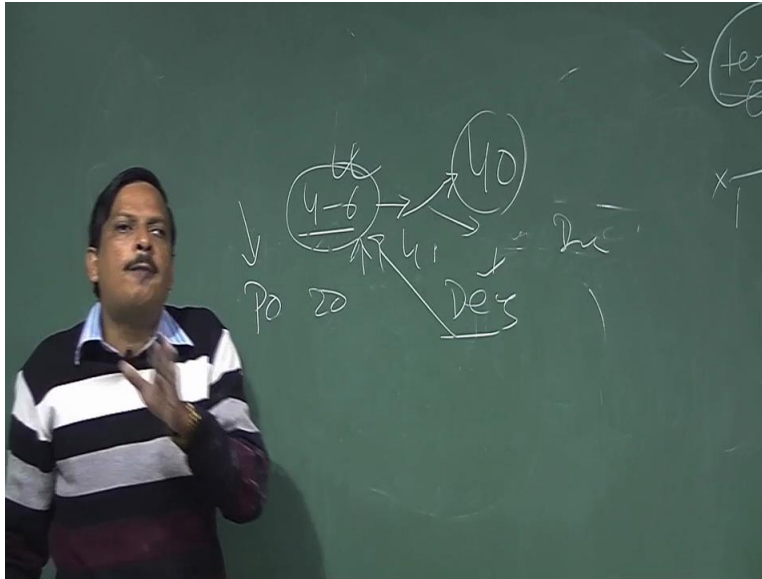


Course Outcomes (Objectives)- COs

- **Typically 4-6 CO s are identified /Course.**
- **COs are major domain specific outcomes written using action verbs which are specific, measurable and can be demonstrated by students on completion of the course.**
- **Course Outcomes should aim to develop higher order skills in each Domain of Learning. Evaluation, Synthesis, Analysis are typical examples in Cognitive Domain.**

Lets I will not going PEO details. Lets go to the course outcome. What is course outcome? What do you mean by course outcome? Course outcome is typically four to six outcome major outcome of the course which can students develop during the one semester study or lets forty lectures. I consider a forty lecture course.

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So I have a forty lectures hour and one semester long course so I define four to six course outcome which will be achievable, which will be measurable which will be specific for this course. So four to six major outcome and if you say if the course is for graduate engineer four year graduate engineer none of the course outcome should be mention student will define this things.

Student will describe this thing because none of the PO parameter whether it is Washington accords or NBA guideline has said the graduate engineer has only to define only to describe. They have to earn higher cognitive level. Next class this later on the Tamali Bhattacharyya taught you, what are the cognitive level of bloom taxonomy all kind of things. I just follow that things so higher cognitive level means not lower level define, describe that things.

They should able to evaluate synthesis analysis, design apply all kind of higher cognitive level. Once I write down this higher cognitive level four to six course outcome and I said this outcome should scatter to has to be achievable by the forty lecture. It should not be achievable by by twenty lectures. Then the my course objectives are course outcomes are very wrong and it should not be that. It will be not achievable by the forty lectures.

So as a teacher I have to find out or write down four to six course outcome which is specific, measurable and achievable within the forty hour lectures and which is not in not lower cognitive

level. If I say today we will be able to describe this thing may be one or two lectures is sufficient to develop the skill.

So that cannot be a course outcome. Student will be able to define Newton's second law of motion then we require thirty minutes not require thirty minutes in ten minutes of lectures. So that cannot be course outcome. So course outcome is the major (23:31) way by the student or I can say the course outcome or the major skill set which will be developed in the students after they attend the course.

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Program Outcomes

Instructional Objectives

A statement of something which is **SPECIFIC, MEASURABLE, ACHIEVABLE** that students should be able to **DO** after receiving instruction if it

Three Important features of a well-written Instructional Objective

- A. The performance component
- B. The condition component
- C. The criterion component

So how to write the course outcome, if you see how to write the course outcome, there is a slides this slide that each outcome must be written based on the (24:00) instructional see or based on the theory of instructional system design and bloom taxonomy. For the instructional system design said a outcome or a objective instructional objective is a statement of something which is specific measurable and achievable that student student should able to do after receiving the instruction. So each course outcome should be a statement of something with student will able to do after receiving the instruction means at the end of the course I should able to do this thing.

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If I say the students will able to design the push pull amplifier in electronics example so what is the problem? Yes it is doable. Design the push pull amplifier but push pull amplifier complexity is very huge so for four year graduate engineer I have to define how much up to how much complexity I should handle this design or they should able to the handle. So if I say for BE engineer up to this complexity is required then it add the specificity on the objective. Then mean that this objective is achievable. Suppose somebody has taught aerodynamics or something then he write student will able to design an airplane.

It is very open ended statement and it cannot be course objective because it is not achievable. Similarly suppose I taught mathematics and I say student will able to solve differential equation. In the objective cannot be because there lot of differential equation available, lot of theories, lot of kinds of differential equation available within the forty lecture of this engineering

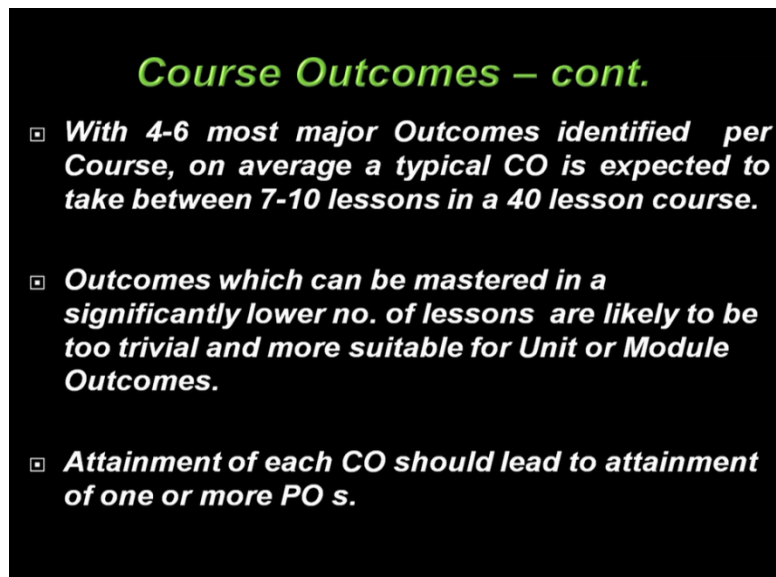
mathematics may be differential equation I may for ten lectures or twelve lectures with in twelve lecture I can develop all kinds of solving differential equation.

So I can say instead of differential equation I make it specificity student for a given second order differential equation student will able to solve it. That means it added specificity that up to second order is required for the engineer. I can say student will be able to design a AC machine. It is not possible the complexity of designing AC machine is huge. So what kinds of complexity the student will able to do? I have to specify. Once I specify that and instructional system design is call those are condition component and criteria component.

So a instructional I can say a outcome or instructional objective should contain three component, performance component, condition component, criteria component. So how do you write? For a given this thing do this thing up to this. So once I the given this thing is the condition component. Do this thing is the performance component, up to this is the criteria component.

So I define what to do? What will be given? Up to what level if I do that for every objective then I specify that objective. So it may be a course objective, it may be a module objective I will come. It may be a unit objective.

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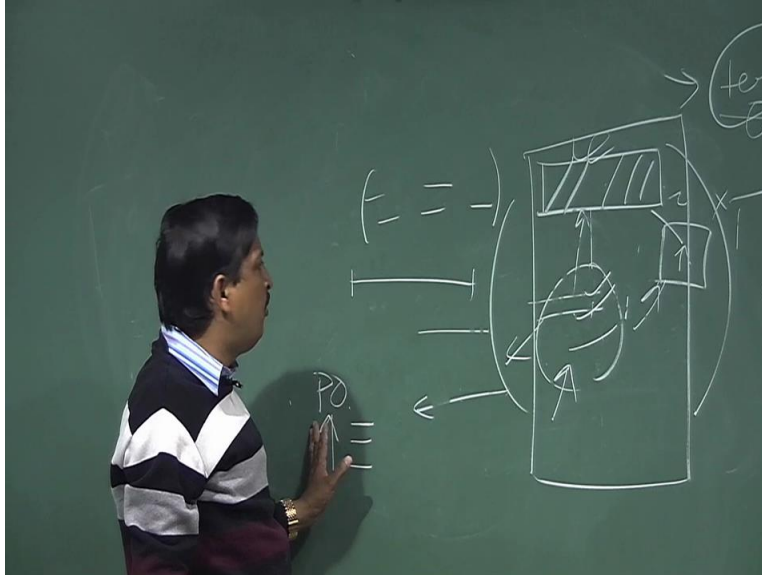
Course Outcomes – cont.

- ▣ ***With 4-6 most major Outcomes identified per Course, on average a typical CO is expected to take between 7-10 lessons in a 40 lesson course.***
- ▣ ***Outcomes which can be mastered in a significantly lower no. of lessons are likely to be too trivial and more suitable for Unit or Module Outcomes.***
- ▣ ***Attainment of each CO should lead to attainment of one or more PO s.***

So when I write that course outcome or course objective course outcome or course objective it should be specific measurable and achievable and it should unambiguous. What do you mean by

unambiguous? That if you write student will able to explain the basic terminology. As a teacher I know what are the basic but as a learner I do not know what are the basic.

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So instead of writing the basic I can expressly mention what the what do you mean by (())(28:37)? So a instructional objective or outcome is not single line statement it may be a paragraph but it should be specific, measurable and achievable. This will be given to the student they have to perform this up to this level.

So sometime we write student will able to understand different algorithm. Understand is not measurable different if I write such as different as example basic all are non-define term. So instead of writing those term please specify the student will able to design this and this only not other things.

Okay so do not write the different things they do not able to do different things. Instead of do different things I specify which do you mean by different. Once I specify them then the goal is achievable, measurable and specific for this goal, this material this test item given to the student.

So students will read the material, try to achieve this goal by by solving this test item. They test whether they achieve this goal or not? If they fail they come to the teacher and ask for the clearance of the misconception. So this added active you can say the active learning or it added interaction with the students.

Once the interaction is added and the self-learning is added so I can say my teaching learning process scatter to not only the domain PEO but also the domain independent PEO building communication skill, building self-learning, building team work, building ethics all kinds of parameter are scatter if I follow this teaching learning process.

So I am not spoon feed the students. I come in the class and give a take lecture from one corner to one corner of a board and to students are copying that lectures and at the examination I say who said this define this, describe this, prove this that will include any student engagement does not improve the any domain dependent skill of the students.

So if I follow this this where you have to go those of the material, material may be a text, material can be video, material can be animation, material can be virtual lab whatever define it here. The students will follow the material as per their requirement. Somebody is a textual learner take a read the text, somebody is visual learner he can visualize the video or go the simulation.

So we are I am not restricted to learn only through my lectures or test item. I am I am not restricted them so I am free to them that you have to you achieve it. You follow your own path. This is the pedagogy inbuilt in this outcome based learning framework that's why we said the outcome based pedagogic principle for effective teaching, so this is the teaching pedagogy.

Teaching learning process is the pedagogy. So what teaching learning process involve is here I am scatter to any kinds of pedagogy that textual learner, visual learner, graphics learner. I do not categories them I have different material is available to them. I have goal available to them, test item available to them and I told the student follow your own space, own choice to achieve the goal.

Once you achieve the goal you succeed. Now slow learner may take more time, fast learner may achieve the goal quickly and they come to the teacher for other things. So if I follow this methodology then I can say I am scatter to not only the domain independent PEO but also I have follow a teaching learning process which increase the student engagement and I am I am scatter to different pedagogical principle for different student.

So this is the advantage. So next class I will describe how what is how do you design this outcome based curriculum for every course. I am not talking about the PEO (33:42) matching. That I can take another class but I will I will definitely explain what should be the course curriculum not only the course outcome but should the module outcome and what is the what should be structured, which can define this kind of which can a scatter to this kind of domain independent PEO and we can which can allow the different pedagogy inside this to for different students okay.

So next class I will demonstrate the software where basically I will demonstrate the structured to develop the course for every teachers. Once you develop this course then you can give it the whole document to the students for their self-learning and once they start their learning so that that their engagement will be increases because they are learning by self. So next class I will demonstrate that software okay.