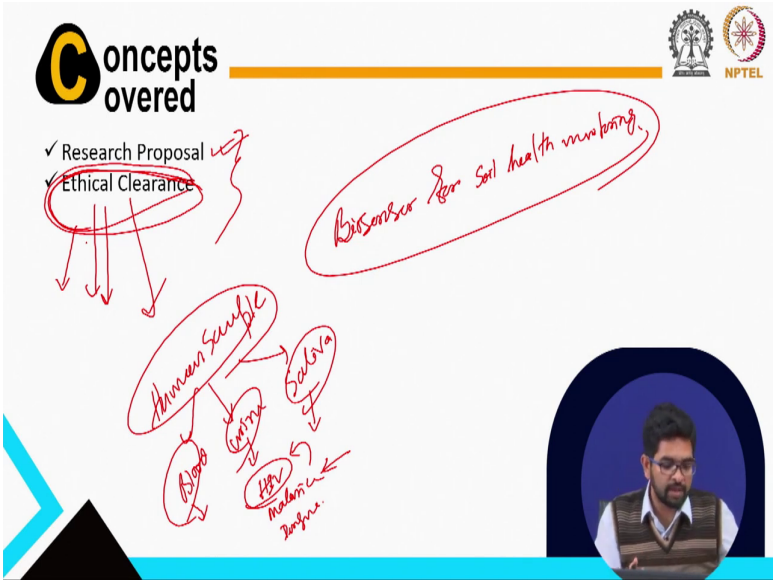
Nanobio Technology Enabled Point-of-Care Devices
Prof. Gorachand Dutta
School of Medical Science and Technology
Indian Institute of Technology, Kharagpur

Lecture - 33
Research Proposal and Ethical Clearance

Dear students, today's class is something new for you. In this class, not only I am going to teach you the basic sensing technology their applications at the same time, I want to train you for the future research for your future career for show that you will be independent.

So, this course curricula is not for only the learning at the same time you will trained for your future career also that is why this is very very equally important this course for your curricula. See in this lecture, I will cover the research proposal writing and the ethical clearance.

(Refer Slide Time: 01:05)



What is this two? See research proposal writing and ethical clearance and this two topic I will cover because maybe see I already gave you so many things right topics. In this area, you can consider you can focus.

Now, if you think about like a writing a research proposal and see if you have to convince to some like other funding agency or maybe if you want to go for like for research purpose, you have to say to your supervisors means some it considered right in the proper way.

So, you should have the proper information how to write your all the whole concept. Suppose, you want to develop a biosensor for like last class I told like soil, health, monitoring right. So, you have a very good concept I can detect I can develop some nano particles it can did monitor the health. Now, you have to write some systematic way scientific way.

So, that is why as we are very close to end of this course, let us try to understands how you can write your concept and you can show this one to the funding agency or to the supervisor so, that you can start your internship or the small project right. So, that is why you should know this writing of the research proposal and the ethical clearance.

What is this ethical clearance? See specially the human sample generally we use you know human samples. What kind of human samples? May be blood, urine or may be saliva. So, this kind of the samples we are using for the diagnosis of the disease. But you know this kind of samples when you want to handle because you will have to drop the sample on a chip and your chip can detect all the analyte your multiplex may be you developed multiplex sensor right. So, that sensor can detect all the analytes at the same time.

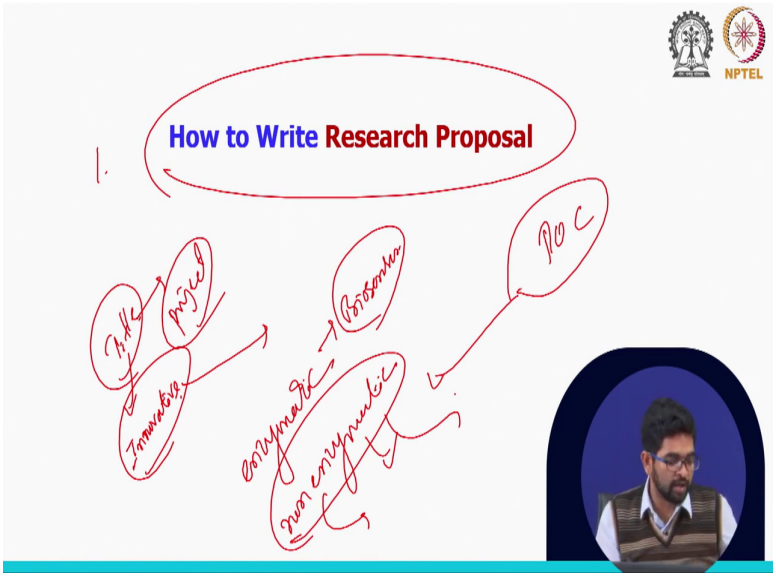
So, it means your sample contains many contaminant. What is the contaminant? Suppose it can be HIV, malaria or may be dengue. So, it means some infectious disease also can be there. You may want to detect malaria, but at the same time it can be HIV impacted, right so, that you should properly follow your detection scheme and your safety protocol.

So, that if somehow your sample is contaminated, it should not spread to like we are healthy persons, we are like you are the scientist, you have to detect all the like all the analyte in your laboratory. So, you should not be affected your colleague that they should not be affected right.

So, how you will handle those samples? So, you should have a very good bio-safety environment right. So, ethical clearance means once you have all the safety protocol, you know the safety protocol, you can do all the safety things before I mean the sample measurement if you have all these things in your laboratory, then you can go for this detections, right. So, ethical committee they will check that you should have those things or not, you are totally aware of these things or not.

Which kind of samples you are going to use? It is the that also this committee ethical committee they will check. So, you should have this kind of a very good informations, I mean ethical clearance is really really important keywords for this course that is why many times I told you know the many samples it can be non-invasive samples or invasive samples, but they can directly or indirectly can spread the disease you know that is why you should have the proper information ok.

(Refer Slide Time: 05:30)



Let us come first the our first topic today how to write the research proposal. So, if first thing you have to consider a topic that is why today I just mentioned let us think first which area you want to focus. So, title first you have to think about the title of your project on which area you want to focus.

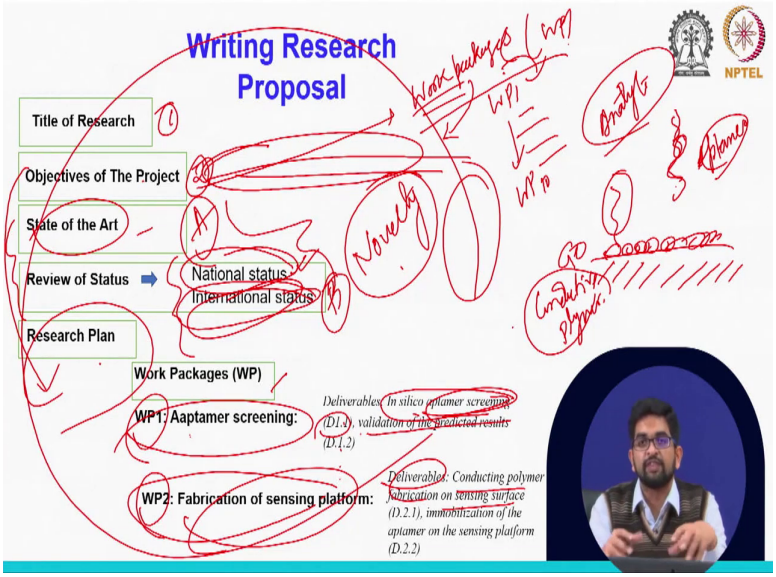
So, this one I will always recommend like it should be innovative, it should be very much innovative then only you can go for some new innovations. I mean say many things already have done, but try to improve those existing technology what is the gap in this technology.

And try to develop something new that can be useful for the mankind for the society or something rapid something user friendly that can be useful for point of care testing or that can be useful in a very extreme conditions like in the high temperature, the high humidity like on field testing that you have to think. Why I am saying see as I told you like enzymatic

biosensor right that you know, but enzymes and different biomolecules they can be denatured in the high temperature.

So, non-enzymatic. So, you may think some very innovative project in the non- enzymatic procedures because if you develop some nanoparticles and if those particles are very much specific for the detections of the analyte, then this projects will be more innovative something like this and it can be used in a very extreme condition. So, first think about the area the topic where you want to focus.

(Refer Slide Time: 07:25)



So, let us show you how we can write the whole things your whole proposal. So, let us follow this step by step all the rules then definitely you can make a good proposal. So, 1st that is I taking the first thing will be your title of your research. This is really really important first you have to focus.

2nd is the objective. So, your title ready suppose. So, your title suppose as I told you like soil health monitoring. Now, what will be the objectives? What is the meaning of the objectives? Object means how you want to start. So, the objectives they may have different work packages. Work packages what is this work packages?

I mean these work packages actually will guide you step by step how we can achieve how we can complete the whole project. So, there may be the many work packages work package 1, 2 may be around work package 10 you can make. So, each work packages should have the all the information step by step all the information how you will complete your project. Let us give one example. Suppose you want to develop some aptamer based biosensors.

So, before the aptamer based so, aptamer based suppose you want to develop some aptamer. What is the aptamer? This is the receptor that specifically can detect the analyte, right. Suppose it can detect some what some analyte. So, in the soil that present. You have to consider which analyte that analyte specifically can bind with some aptamer.

So, a very specific sequence you have to develop. So, your first job is the development of very very specific aptamer. So, this is one work package for your and this is a this will be a one good objectives of the project first projects will first objectives will be the development of this aptamer. So, it can be in silico aptamer.

So, and you can see I mentioned the deliverable D1 means deliverable. So, there may be lots you know in a single work package there is lots different different deliverables. Maybe you have to first validate your sequence then you can apply those aptamer on the sensor chip. So, all the deliverables you can mention 1, 2, 3, 4 each work packages it should have the sub points they are deliverables.

So, first you develop the aptamer then you can go for the validations. I mean really this aptamer is ready for detections or not, ok. So, you understand what is the work packages then work package 2 you can come after the aptamer development you just add this aptamer on a sensor device, right. So, you can add this is the another work package in your proposal.

So, there is one deliverable can be in the in this work package one deliverables can be your immobilizations of the aptamer on a like conducting polymer or maybe some graphene oxide modified sensor right in a graphene oxide modified sensor or maybe conductive polymer. So, those can help to bind your aptamer on the surface. So, this is on deliverable. So, like conducting polymer fabrication on sensing surface.

And then you can immobilize the aptamer then after that you can go for the detections of the pacific analyte. So, this is one another work package. So, these all the objectives you have to point out in the when first you can summarize these objectives then you can go to the full research plan very systematically you have to write.

So, first you have to think about the main topic of your work then think about the objectives means what is your goal what is the aim of your project that just you have to write down then you can go directly to the research plan. So, in the research plan it will contain like as I said different different work packages work package 1 and it may contain different different deliverables each work package may contain different deliverables ok.

So, before like after the objectives research plan you have to think like two step this is A and B this is very very important you have to write during the writing of your project one is a state of the art and another is the review status what is the state of the art means you are thinking some area to write or to start some work.

So, what is the research gap? Maybe there is some many number of people all about the world they are also working maybe in a similar area, but they are not focusing exactly what you are you are thinking not exactly, but something else also they are working you know. So, there it means they already published or they already have done some work and you are going you are going to start in some another area that is much better than their work.

So, it means there is some research gap. So, you have to write those gap then only people can understands the novelty of your research ok this is very very important the state of the art and

review status. So, you have to review more papers that already published or already have done by other group and let us find out the gap.

So, novelty novelty this one you have to clearly mention by writing these two things on a state of the art what is already currently available and what need to be done. So, you can check like review status like national status, international status, sometime the problem may be very much localized problem may be in this area only it is really really important and we are not maybe equally important for all over the world. So, you should have to think like which area this problem actually occur is really important.

Naturally you have to think also like whatever problem we are thinking in our country how much important this one ok. So, whatever the national status either in all over India any other groups also working in this area or not that also you have to check and you can approach to your supervisor or maybe you can if you even if you want to start your own start-up that I told you know.

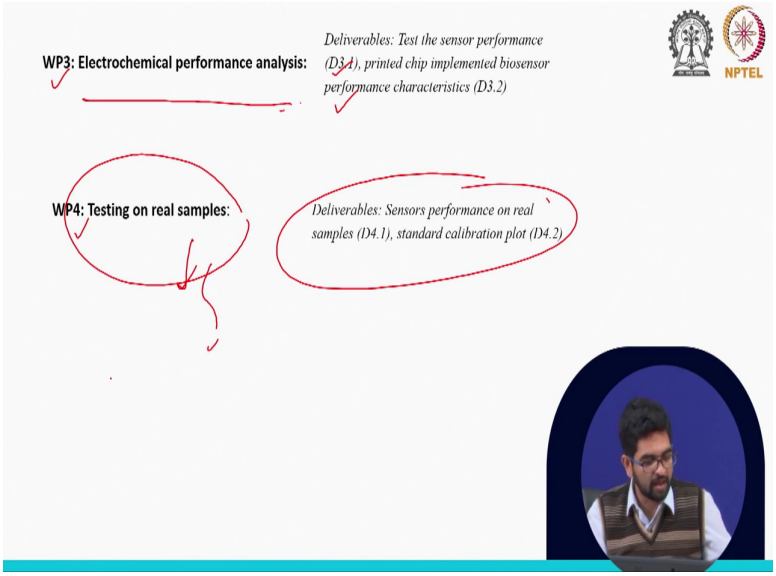
You so you may have one R and D section there also you can think in this area what is the gap and international status means if you want to develop these things not only for your country mean not only for our own nations not for our India our own country maybe it can be equally useful for the outside other country also.

So, that also you have to think in how much research they have done on this area maybe they may already developed some see one area you maybe just thought that let us work on a glucose monitoring chip I taught you many way. So, some international group they already developed, but because of the patent issue copyright if you want to bring this technology to India it will huge expensive.

But if like made in India type like indigenous if you can develop something which cheaper cost then it will be very useful in the nationally that is why it is not like this, they already develop you cannot do something else, yes you can do something else based on the price we if you buy their technology, they want to bring everything to here is a huge expensive.

So, you can think about how to cut down the price right that also kind of the good innovations that is why you have to think about like different national international status of the research. See as we are very close to this of course, end of this our course now that is why you should have this very basic knowledge of the plan that you want to start ok.

(Refer Slide Time: 16:06)



Now, the all the work packages that I taught you there may be another few work packages, but all the work packages should be very much clear. I mean how you are going to I mean how to complete your whole project and all the deliverables you have to mention very clearly suppose see the electrochemical performance analysis.

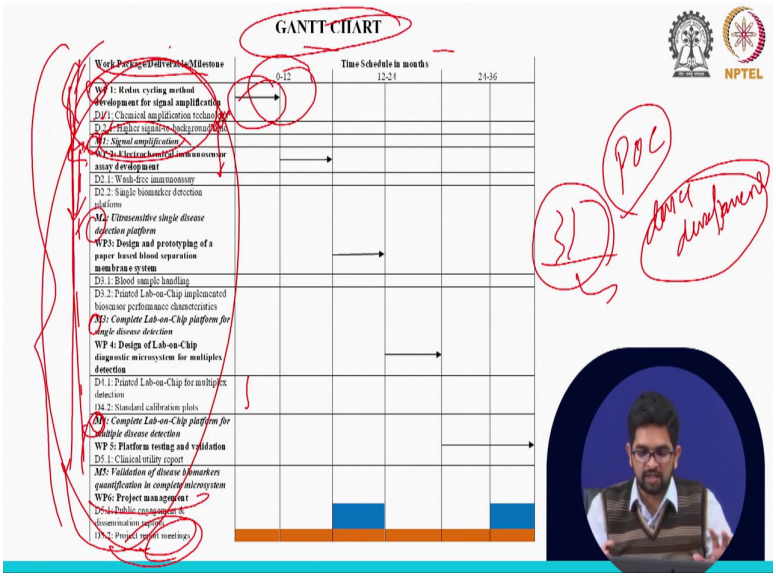
After the fabrications, aptamer for the detection of the target analyte maybe you are going to perform like their performance of the device that step by steps you can mentions it should be

clear to your writing then testing of the real samples then those deliverable you have to mentions in this paragraph, ok.

Then finally, you can go for the disseminations you can tell you can publish the work you can tell this ones to like the to the industry you can approach and you can try to commercialize this innovations that can be done in the end of this project. So, one work packages can be this dissemination subject project.

So, this is just a format it is not like the standard you have to follow this one you can think some innovative way it is totally up to your you know way your writing skill this way, but it should be very well organized properly you can think first and then start your new work clear.

(Refer Slide Time: 17:36)



Now, the Gantt chart this is very very see I have just mentions the example when if you want to start a research project just make a chart like this. See you can see here I mentions like different work packages first if this is a this is a column one work packages then all the time scheduled then you can schedule your time. Then only you can successfully and very I mean you one time to come so, that you can complete your project, right.

So, first 12 months you will do this kind of like first suppose you are developing a redox cycling method that I taught you. So, those redox cycling method and the like chemical amplification signal-to-background ratio everything can be done within 1 year or within the 6 months that you just make a plan then start your work. So, you that it will definitely it will help you to predict some uncertainty.

Suppose in this plan suppose you are developing some chemical amplification technology it may not work properly right. So, based on your plan maybe you should have some other work packages. So, if this plan may is not work you may think some other work package some other plan accordingly you can make this table. So, you have you should have the some backup plan also if this work is not work how you move right.

So, anyhow you have to complete this work successfully you have to complete for that you should have some backup plan. Those also you can just make a list and all the deliverable you just make a list see this plan and let start and M means the milestone means after this suppose in this case see we are developing a redox cycling amplifications that will help us to get the higher signal to background ratio.

So, the milestone will be you will you successfully completing the amplification strategy for your biosensor development that is your milestone. So, something like this way one step you will achieve one milestone you will complete successfully then go to the second work package and achieve the second milestone ok. So, like this way you can complete the whole grand chart.

See then work package 3, work package 4, work package 5 all the work packages (Refer Time: 20:01) you have to make one milestone step by step you please complete it and then you become a successful for this project. And as I mentioned that finally, you should have a like you can validate your sensor chip by using some real sample and then you can disseminate your result to the public.

So, that your innovation not only it will be inside your lab it should come outside your lab. So, you should you can develop some device. So, common persons the Layman this should also use. So, your society should be benefited. So, the this is highly recommended because this course will design such a way.

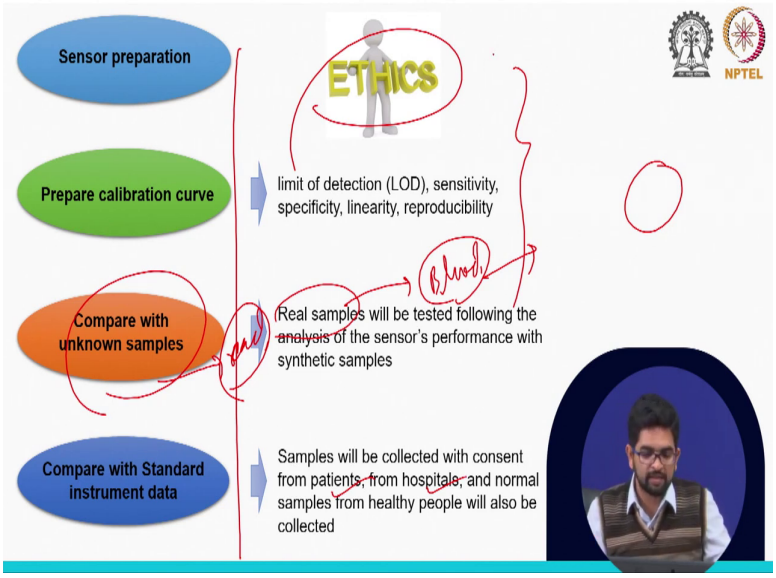
So, that this concept you can bring to the point of care testing device development. So, we have to focus how to bring your concept finally, on a chip. So, that your innovation not only inside the lab it will be it will come to the market. So, such a way you can means you can arrange you may need some collaborator because this kind of innovations is highly collaborative, right.

So, then you have to make some your work packages and maybe you have to go for the regular meeting with your collaborator because it is very much interdisciplinary may be you are biologist you may know the all the steps of the biological molecules. But you do not know how to integrate this sensor with some electronic power electronic instrument. So, you have to collaborate with some electronic people.

So, you should have the a regular meeting with them and collect the information accordingly you have to make your whole work packages accordingly. Maybe you have to make one.

So, within this time with after 2 months or after 4 months you will meet regularly and you will get the output and you will achieve the milestone such a way you have to make then you can complete you can successfully complete your project ok So, that is the thinking that is the thought actually for today's this proposal writing.

(Refer Slide Time: 22:11)



Now, next topic I am going to teach you today that is the ethical as I told you after writing the project you have to think that kind of sample you are using for your sensor development. So, if you really going to use some hazardous sample some infectious sample like some blood sample like urine sample, saliva sample they may contain some different kind of infectious marker.

So, that is why you should have the proper information. So, ethical meeting that is why you have to go through some ethical meeting. So, the where the expert they will critically evaluate your proper project and then they will give you the permissions let us go for this development without their certificate of permissions you cannot complete the whole real sample testing.

So, that is why your project should have this all the topics one is a sensor preparations then calibrations of the sensor then compare with some unknown samples and with the real

samples this unknown sample or the real sample case you need the ethical clearance. So, you please think here in this case like the real samples that I just mentions it can be blood samples right if it infectious kind of disease present. So, do you have the proper facility or not.

Also, to the ethical committee you have to inform that how means number of the samples how many like samples you are actually going to collect from where you are going to collect who will provide these samples to you and you have to make a consent form for those volunteers. May be some volunteers they are giving the samples to you. So, they have to sign in this consent form that is yes, they are giving the sample for the research purpose ha something like this you have to make.

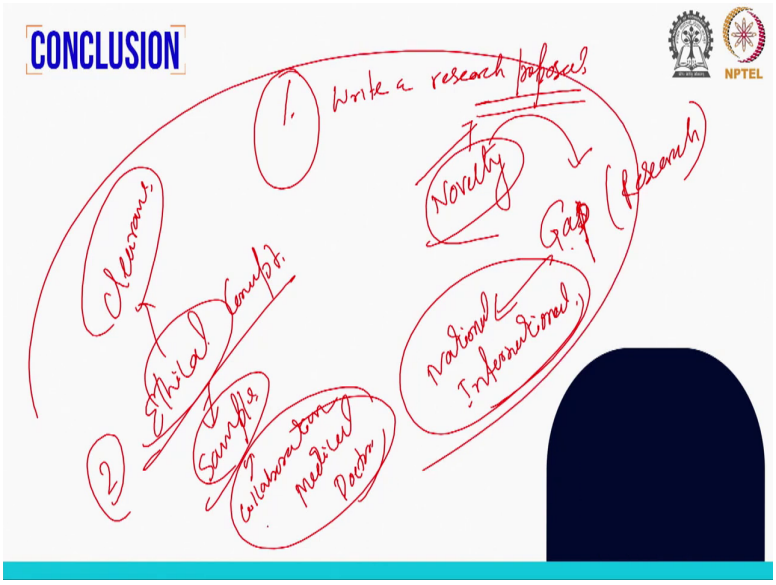
So, the this procedure you have to complete. So, that is why whenever you are thinking some device development with some this kind of hazardous real sample or some in fix it can in it can spread some disease because of the sample handling for that case you have to properly follow the all the rules and regulations that is the ethical committee rule and regulations ok. This is very very important otherwise you cannot complete basically your whole project.

So, another things like samples can be collected from with different kind of patients from hospitals. So, definitely you have to collaborate with some that is with some doctors, why? You got your doctors know how to collect the samples maybe you are the scientist you are developing the device.

But you do not know how to collect the samples definitely you will not collect maybe because if you are not doctors definitely if you are non doctor you have to be (Refer Time: 25:13) basic scientist you will not collect the samples by yourself.

So, some special right doctors they should involve with your project. So, they will help you to collect the samples and they will guide you how to handle the samples then let us add the samples on the device and check it, ok. So, this is the things you should have the information's and then you are ready for the device development, ok. So, today that is why I taught this is a very important part the ethical clearance.

(Refer Slide Time: 25:50)



So, what is the conclusions for today's topic? So, today I taught you 1st the write a research proposal. So, writing this as proposal is really really important here you have to put your innovations your idea, but just always think the novelty right lots of research going on, but really this research is really important for the society let us think this and think the gap. What gap? That is the research gap.

So, you have to think research gap nationally, national and international, right. So, this way you have to think like what is the research gap then try to develop this your concept and stuff. So, why before the starting of your research? So, you should have the ethical concept what is the ethical concept I mean kind of sample the sample you are going to use is really the infectious how to use the sample for that definitely you should have a collaboration with some medical professional some medical professional or medical doctor.

So, they can basically help you to collect the samples and (Refer Time: 27:19) sample they can basically help you. So, for that you have to collect the clearance. So, ethical comes you have to collect clearance then you are ready to for the device development ok. So, that is why these two things that I taught you is really really important before closing this course work.

So, let us prepare let us think and be ready for your of your own development you become a independent researcher and you can start like I already mentioned before at the very beginning of this course work it will be the independent researcher, it will very much innovative for your own thinking like this way you can start your thinking from today itself ok. That is all for today.

Thank you very much.