Lecture 18:
Important Terminologies in Offshore Environment

Welcome all, to lecture 18. So this is a continuation of previous lectures, particularly let to offshore investigation method. So, we have started about introduction of offshore investigations and offshore environment, different terminology we have discussed, how we go for offshore structures? What are the different kinds of offshore structures? What are the applications nowadays, when we go for offshore investigations techniques? And what kind of structure generally we target? So, we discussed about sport islands, we discussed about artificial, artificially created islands, support ports also. Airports nowadays people are constructing now, now we can see like between, connecting islands and over larger distances about the sea floor, lot of bridge are naming in construction practice. Then we know, like pipelines which are particularly, stage along the sea floor, for island, gas transportation even from, the exploration rake on to the refinery, all from distant location also .So different location are there, different purpose are there, for which pipelines are also aerated, across the sea floor, then we also discussed particularly after malware second and after that also, at many times, transmission cables are also, spread across the sea floor. So that is another environment, which is particularly important, as for as, the application of offshore environment related to, different application of human requirements of are constant, the point of highlighting these is like particularly ,when we take about offshore, only the oil and gas exploration these comes to the mind. But, in addition to those structures, number of other structures are also available, which are usually consisted of offshore and now a days because of, limitation in terms of landmarks available, for further expansion of cities, meteors and urban centres, nowadays what people are going there going more in to the seas, engrossment and then filling it, suitable meteor ether from the same location or may be from different location. So that can actually create, an artificial island for application purpose, you can also in given an growth, in terms of tourism, because you can create lot of activity around those, so those are again another kind of offshore investigation. So we are discuses, different kind of offshore structures, which are primary inconsistent award, is and then, we also discuss like what are the challenges, which generally coming up, because of the present sand dunes, because of the present water current, because of the, the binding characteristics parasytemental, which is present at the sea bed or by, by subsequent decomposition of calcium carbonate, available generally in bounders, because of Mara life which , which characterize bending characteristics of, material which is available at the sea bed. So depending on the which is available at near in the sea bed, we can go for deter investigation and other important consideration with generally, do not come into close, it's like ecological system and regulator word is, which are where the guidelines relatively different from, corresponding on shore structures. So we have to make sure like, before and after the construction of particular offshore structures, they ecology, the flora and fona of the environment, gets back to its original position, as close as possible without minimal disturbance to the aquatic life**.** So, we will discuss then, we started like based on reconnaissance survey, based on earlier public literature, based on investigation method, investigation based findings, which may be reasons specific or counters specific, a related to may be, geological environment, finding may be related to depositional environment, may be related to topographical features finding, may be related finding of sesame characteristics or sesame sources, in a particular reason or across this study area or may be, enter country. So lot of investigation, have been, have been time to time, also including the, the area which are in on offshore environment. One classical example, which i would like to give hear, like a particularly when, when constaction of any kind of dam or constaction of any kind of nuclear ball plant, particularly in the on the costal reason is proposed, so particularly in order to identify the chance of tsunami, you know to identify the chances of seismic activity, in a around that particular important structures, nuclear power plant, in order to ensure that the, the, the damages should be minimal, as minimal possible are, are generally it not should be allowed at all, because of there is any kind of leakage in the radiation it will cos, more devastation. So for these kinds of structures also, before you go for detail investigation, in order to ensure the suitability selected side, with minimal chances the side is getting effected may be by

tsunamis, may be by, may be by seismic current and so on and so forth. So, we have to go for detail investigations, before any, any kind of Site-Specific investigations. So to giving an example, like gravity method and magnetic gravity method, these are widely, adopted method, whenever you will go for detail investigation, over the larger area, which may or may not be related to particular side or particular structure kind. So, usually when, whenever these kinds of reports are available for, for the reason which containing you are in-situ which adjusted in your in-situ of interest. So, one can always refer to those kinds of information, which is already done and which is already published also they people also refer to that, that can also get in a ideal like, what kind of governing factors for a, the kind of deposition, the kind of innovation, which are responsible are governing, the sedimentation or the, the soil type, the topographical features, the, the geological features and at the times, the geological features which are governing the overall process, happening the particular reason, can also be under should, based on detail investigation or referring to the detail investigation, perform by the, by the exports, in the vicinity of the reason earlier. So then we started about, geotechnical investigation also, we discus about how, how we can do cone penetration test? How you can go for venesiya test? And all those things, we have discuses.

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So the topic which have been covered, so far because this is the last topic offshore investigation module. So we are discussed so far about, so what is offshore environment? What are the different challenge in before that, avail people for like we should go for offshore structures, as we discus like there are codeines, there are ocean, which can be into present configuration or which keeps are changing configuration, in geological time scale and mine governing factors, which is responsible for moment of this kinds of be continental plates or oceanic plates is the conversion current, mostly in the upermental, because lower mental though, though conversion current is there, but the, the amount of conversion generated there, the driving force which are generated from the lower mental is not sufficient, you know to cos significant structures at the interface of mental and the curtest and the subsequent driving of the cluster medium. So then we, we say, we also saw like depending upon, the what are the governing factors, at the continental as well as the ocean interface so that, that can be, the interface can be Ajantal, it can be a steam and the geomorphology, also will be governing this effectors, then the thickness, the relative thickness ocean aircrafts, as well as the continental curtest, at the transition between oceanic crust, on the subsequent continental curtest, a cures, so that will also

govern. What kind of transition? What kind of zone will be there, between the continental curtest as well as, the oceanic crust, then we discuss about continental shift, continental margins and continental rice so on. Which subsequently also gave, indication like white is important to go for, continental margins study. But, permerly for exploration of minerals, for exploration of gases, by, oil and so on and so forth. So that's how it as started and then subsequently for the other kind of structures, where the sport port artificial islands, for airports for a human colonies, for bridges construction, lot of other things coming to picture. Then we discus about sea bed, sea bad material what, what limitation? What, what important characteristics to you are consider, where the in terms of banding characteristics, where the in terms of poisonous gas which is, which may be available at the sea bad, which can also compromise investigation and subsequently, at the later stage you are a, laying of the foundation of the itself, as well as, what kind of, once you know, the sea bad material characteristics, you can also different, what is the most it well method, which can be used for, detail investigation and subsequently what kind of foundation can be adapted, then we also discuss, what are different kind of offshore structures, geo physical method, geological consent and then, the last lecture discus about, geotechnical investigation, more pressly like, cone penetration test, as well as, venesiya test and dynamometer test also, we also discus and what are the advantages and we also highlight it, like a mostly venesiya test, dynamometer test, Cbt test, all are test can be done, either directly from the vessel or by lowering the investigation assembly, to the sea bad, and there from one word you can actually subsequently to the test, from the sea bad, down word .

So those things we have discus in today's class, we are going to sum more important terminology, which will particularly help you in understanding, a different terms or different investigation, different like sum of the standard terminology, which will help you, in better on standing about, offshore environment and subsequent investigation. Like one important characteristics, which comes in to, which are particularly for a exploration rates, like sum time depending up on water depth, depending up on sea bad characteristics and depending up on kind of rates your providing, sum time you go for rating system, sum time you go for Anker systems and fixed system and so on and so forth. So, one is primarily the kind of rates or platforms, generally we practice for, offshore investigation related to oil and gas. Second thing, when we going for this kinds of platform, what kind of support system can be provided. Particularly in case of fix, your directly transferring allowed platform to the sea bad, so where are the platform is sufficiently strong you know, so that, its abele to transfer from the entire lode from the, super structure or the hull or binding system, to the sea bed, without significant distraction of damage. And also, depending upon the sea environment, whether the system, will reminds sustainable during it design like, so one is like physical condition of the system, will remain in intact, during the design like. Second thing, it should not unto going kind of failure weather it is, bearing failure or its sentimental failure. Third thing, the medium on which you finally transferring the load just like onshore structures. So one is super structures which in this particular cases your hull, a vanning system or floating system. Second thing in, in offshore structure, in onshore structure, you are having a shallow foundation, pile foundation in this case also depending upon what kind of structure? What is the, what are depth? What is the load characteristic of the exploration rate, you can go for floating and you can go for fix system also. So the characteristics that particular system .Third one, just like in your onshore system the, the baring medium, should be capable, should be sufficient enough, to which stand over the load without, going any kind of baring capacity failure or subsequent settlement. So, the same thing in this case also, one when, one is the interested should go for detail investigation, for sea bed material. So for we discuss about sea bed material, now we are going to discuss about different kind of platform, which are the particularly in practice and what kind of connection between platform in the sea bed and what kind of sport system, you are provide at the sea bed, because there are, there is what a in between the your exploration rate, as well as the sea bed,

and water is not stable its, its continuous motion, there are wave current, there are drag forces also and sum time because of tides fluctuation water level, as will. So, so, so all those we are going to discuss. So basically, the purpose of today's lecture is to give you more in side about, offshore environment, that's why the topic also suggested.

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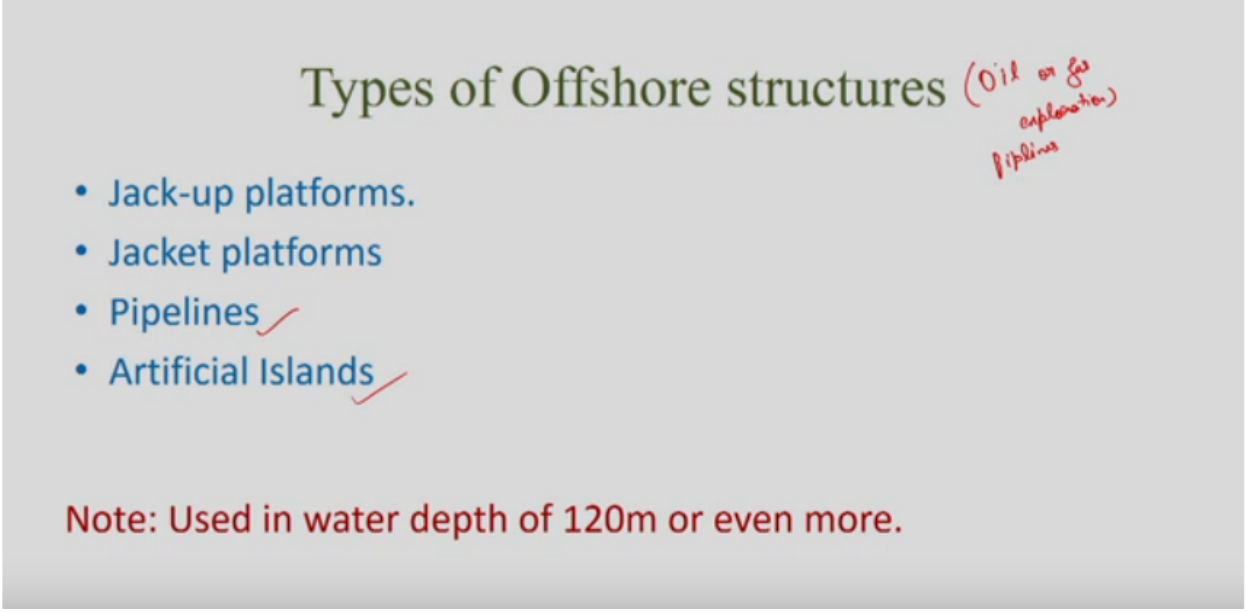

So, the different kind of offshore structures. This is particularly, I can tell, related to your, oil or gas exploration, to other kind of structures like, artificial islands sport ports and all that, those when we go for the more, two important consideration like, the medium at which you're going to construct, it should have minimal effect against, water current. And second thing, the material which you are actually going to construct, at artificial islands or support port, that material should be, should have less eroding characteristic, against the wave current, which are available at the particular location. So, so related to today class, it mostly like offshore structures, which are particularly use for oil and gas exploration .And some time for, pipeline also. So again, will not be tacking hear, about the transmission cable, so mainly the platform, whenever we go for kind of structure, ether you will, ether you will hear about, jack-up-platforms or hear about, jacket platforms, pipelines as we discuss. So pipelines, can be used to, to transfer the, the oil which has been explored out, which has been drill out, from a particular storage, on to the storing assembly there itself, as well as, to transferee from storing assembly to the sources, where, where you are going to transfer it, letter on defining and transferring the different location, can we done from shore assembly. So that is and the third and next one is, artificial islands, so which can be use for even for ear action of communication towers also an, an for other kinds of structures, offshore structures. So, note it as to be like majority of times, the offshore structures, which are generally, we discuss, we have discuss hear are suitable depth of 120 meter or so.

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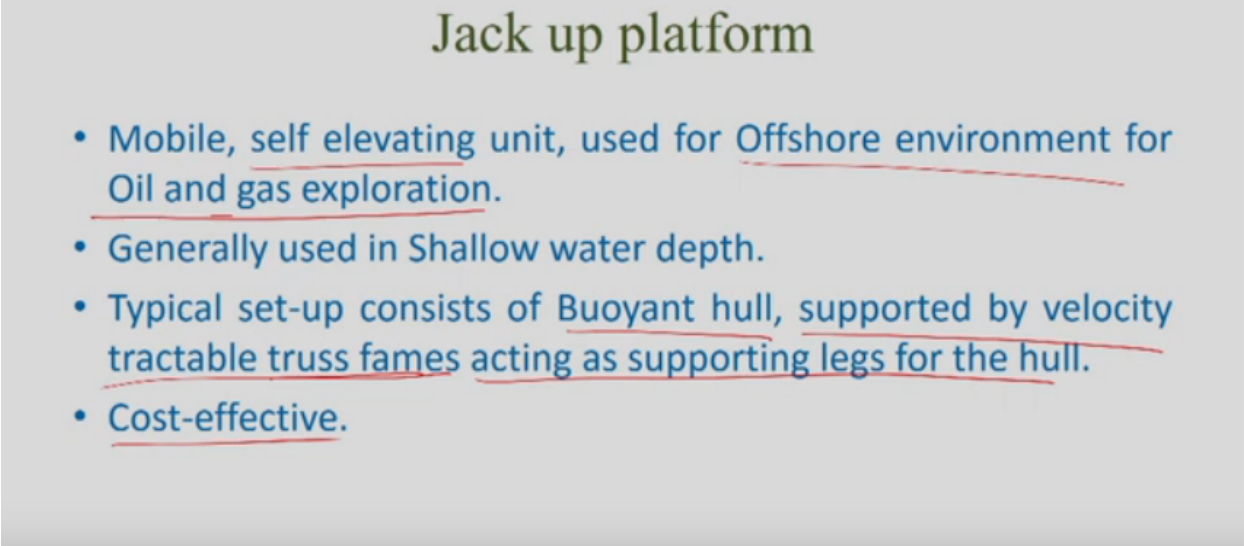

So, when we talk about, jack up platform. As I mansion, particularly the, the, the, there people where raised up for the this code, this should get, better understanding about, because unless no about jack up platform, jacket platform, artificial islands, related to again, offshore rates. So these things will give you understanding to understand overall system, how, how, how Gio physical or Gio technique investigations are going to understand, or going to Gavin subtlety of final structure, which may be jacket platform, jack up platform and so on and so forth. So that's why this is more important, subsequently to understand, what is the meaning of different terminologies hear? So jack up, jack up platform it is basically a mobile devices, mobile means, you can actually keep on, depending upon your side of interest, you can actually transfer it, it is self-elevating unit, as, as the name suggested jack up platform. So, the side of interest where you interest to irate the system, you can actually take this platform, so it is in the form of may be vacillate, it may be form of hull or it may be in the form of some ship assembly, such that, there are kind of steal and tractable truss, which actually get erector and subsequently, once you are erectoring those truss at the side of interest, these hull assembly, can be actually lifted, from those truss, depending upon water depth and so on and so forth. And later on once you are to move this assembly, to lower location to other location, you can actually bring the hull, do in contact with the water and then subsequently drive to other location. So ether it can be, to away system or it can be self-difference hull, where you have a the, the engine other things with in the, hull itself. So, it is mobile, it is not a fixed one, depending upon the location you keep on shifting from, one location to other, use for offshore environment for oil and gas exploration. So generally it is used in, shallow water depth, is the discuss about, earlier. So the typical set-up consists if buoyant hull, which is basically you're a resting platform, through which you are actually doing are a, exploration exercise. Supported by, velocity tractable truss fames, so it is like hull, they stay able flat form is there, which will be sport it, from four sides or three sides, by means of truss fames, this side you will having a truss fames, which will be in fame, in, in Colum fame, which will be actually sporting, this platform stability against, water current or, or the see, see surface. So this acting are the supporting legs for the hull, so above this, hull is there, depending upon the water depth, it can be shifted at the up and down. And them, the major advantage here is, the jack up platforms are, very cost effective. So that's why, why are the location, particularly when we are going for exploration in, in few hundred meters like 80, 80 to 100, 120 meters, you can actually go for this kinds of jack up platforms or even lesser then that.

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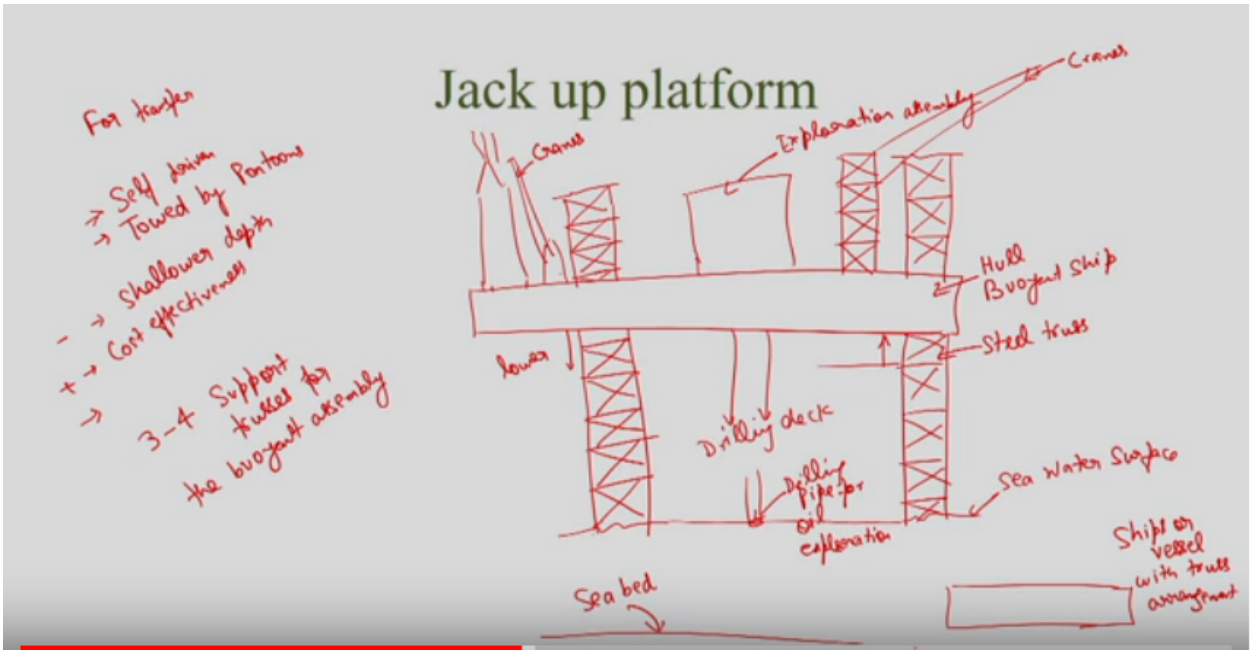

So, typical jack up platform will look like, so it is mansion hear, it is like you are having a hull, on which you can actually have your, drilling assembly and then, you can have lifting cranes also here. And same way you can have, one fear platform also and then, basically it is like, this assembly will be having. So this is like, steal truss, this are actually within the sea. So, this is your sea floor, no, no these is your sea floor, sea water surface. So, one of this, this is erector, so this is your steal truss and same here. So, you can minimum there and even four also, kind of this truss. Now, what we does, so all your assembly which is use for exploration part, you can consider may be hear? You are exploration assembly is here, then you can have this steal truss and this is basically here, hull or buoyant ship kind of thing, which is basically, I mean, if ,if you, if you left that, if you put that ship on the sea bad, sea floor ,water surface it will basically float. But the beauty here, then you can have this fire chamber here. So, you can steed truss assembly from here so, this you can consider may be drilling deck from, which you can acutely start your exploration assembly. This drilling pipe for, for oil exploration. As I mentioned here this is, I mean you can if minimum 3 to 4 support trusses for the bind system, ha here beauty, beauty here is like this system depend a upon water depth it can we raison it can we lower. So, this like jack up platform. So, just like a jack it can kids depend a upon water depth. So, water reach is a you can actually for there lifted up. So, it will be clear distant between in the water surface in here drilling platform, you can low hired if the water depth less and you can dayside if water depth more and one is it's done. So, you can 3 to 4 support trusses here. One this is done you can actually lower this is assembly so, one is low assembly, it will be like as behind, assembly are it can be like if from ships or vessel with truss arrangement. So, one we done with trussing here you can actually lower it, the platform will come in contract with a water surface and then you can. So, this can be water surface is and then you can so, this can be, this can be self-driven, the form like whenever you transferred it from the location other location, for transfer the a self-driven are it can be like towed, you can actually towed this thinks which is a by means are some other platforms. And you can drilling it on to the other location we are very, we are going to go for expressions it second location you can towed, it can be towed, towed can ba self-driven by means are pontoons, can we done here same you can you go for jack up platform the on lee advantage, shallower depth you can used it. Its more cost effete that's another plus point, a cost effectiveness this a more then hundreds of jack up platform, you can actually see a cross glop, use in expression purpose then you can have a lifting left in cranes also here you mean are we some lifting cranes. So, this is about

and this you're so, some here will be the water Seabed, this is a sea bed. So, basically it's like based, on a site in basin your detent invocation from jio physical jio technical test you understood like this a location, which you site is go to go for and exploration purpose for which have done the feel invocation then we can go to the site, the ships which can be used ship also because it as a characteristics in flow it in, in water once it you bring it on to its right position you can actually irritated, by means this lowering truss lifted, of the jacked it jack up and depend a upon water depth. And you can started expression purpose, once it's done you can lower the hull, once is come is contract with water, you can transfer into, other location self-divining are maybe to I means pontoons and then repeat the same work for, how many location your do that teat are expression purpose, other one is,

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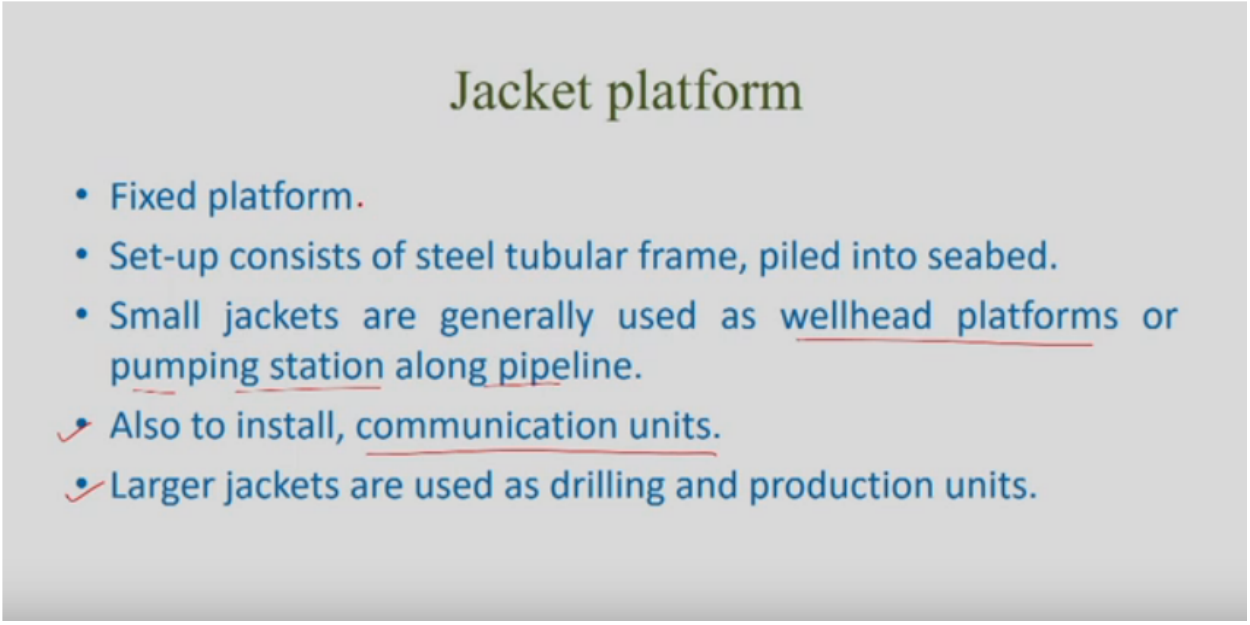

Jack up platform. So, jack an like a jacket platforms, these are mostly, fixed platforms, you cannot actually moved upon down wherever you veractor system in that platform remain here only again consists steel tubular frames, which actually pile into the sea word. So, unlike previous, this is more or less fixed one, once you are, once you have erected it you finished expression part, set up consists of a think is small jacket, a generally use is wellhead platforms or pumping system along pipeline. So, small jackets platform, which can be for shallow adapted, you can use it to, to reshape pumping arrangement along a pipeline. So, that in order maintain sufficient pressure, which will we requite, for the flow of oil or gas to distant location. So, that is where pumping system, sufficient interval will be requite along the pipeline. Again it can be it also use as a support system, because it is a variation stable system which, which can also we be provide to install communication units everytime, because you are in some a remote location, in, in a in expression. So, have to win I mean should we some where we will to be contract with the other people, in case of un excitant also, in case for routing proposes also. So, this jacket platform can also by use, read communication towers on there. Larger jackets platform generally use, for drilling and production for units. So, it keep is on, drilling keep is on getting oil from different dept and, and then, litter on you can used for transfer it on to the surface.

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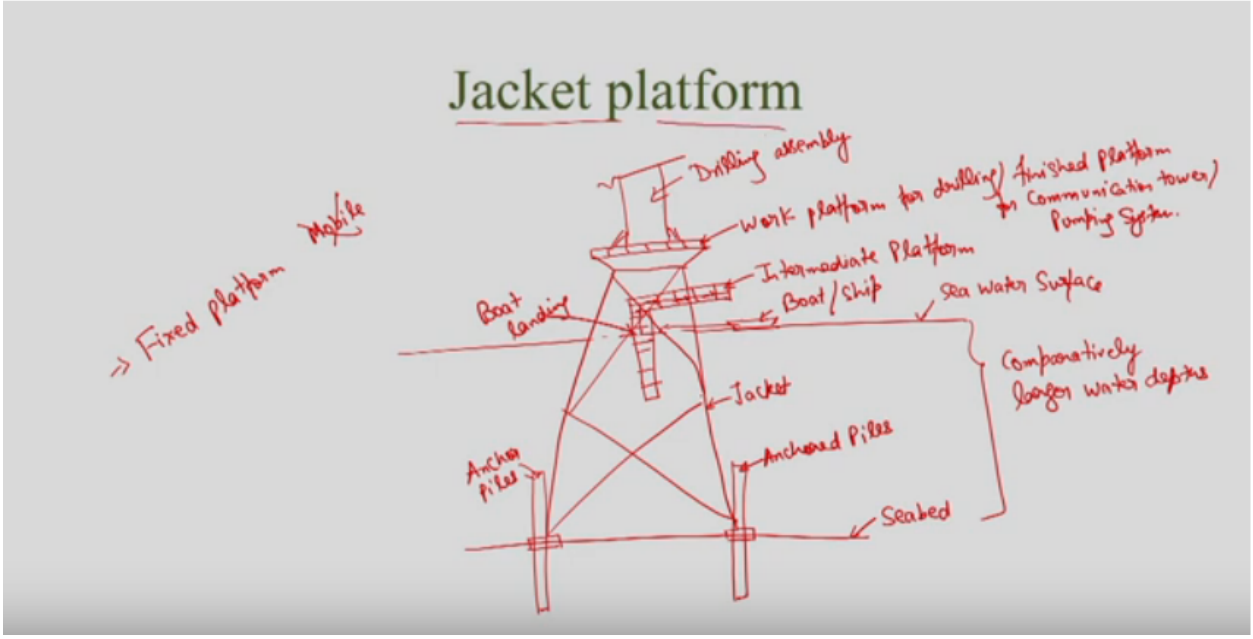

So, unlike jacket platform which we, we discussed about a in the jacket, in jack up platform, which are mobile lesion these platform, more all less feeds and nature then consistent this may be, your seabed because it is a fixed platform. So, generally with go for any kind of a, steel a like cables and anchoring for rather use an only anger pills. So, you having a support system here, followed by there will be some pile system here. So, this here there anchored piles this also anchored pile, which to ensure your sel system get sufficient, regions from the foundation again any kind of lateral movement a drag forces by water current, sense so and so, fear . Now then your you will having a many unit so, like this, this will be generally have appear water, sea water floor, sea water surface in the level at, which it's the its Seeing air then that. So, base on this also it can idea, in compurgation to jack up platform, jack up platform are all, first of all fixed and use tend comparatively lager water depths, again over this you have intermediate platforms. So, you can intermediate platforms also and of that you can here, assembly here, this you can call later finish work platform, other platform on which actually you can electrical transmission, communication towers are maybe pumping system. So, it can be use as work platform if you going for drilling or finish surface, finish platform for communication tower or pumping system. So, if drilling you can attach actually your drilling assembly here. So, this is like aborted picture about, how a jacked platforms, looks look like a you can actually refer to some on line medri also get exist picture how, how a hence to jacked platform look like and what are the different kind of platform and different units, also a cross the depth which will be used and what are the different application of these units, which will we installer different, different location along a jacket platform. It's to mention like a this are the fixed one. So, unlike your jack up platforms can to be moved so, no mobile when sure are done you are actually, dismantle is and done bringing on to the, I mean then only you can, you can actually I means dismantle require, before you can actually go for other location for installation it cannot by use as this form only caller anchor piles this is called a,' Jacked', this generally use. So, that in case there is a kind of boat or ship, which is coming on to the it can come here from this it can be actually come on to the surface. So, this is called as,' Boat or ship', for transfer of a machinery also and event for times for during refer are part also people can low down from here, it can do the work. So, this is called as, 'Boat Lending', this is work platform so, on so

four. So, this about jack up platform next time when we see about a platform depend a what kind of platform, weather platform is capable of change in side particularly, working platform, you classify it as, jacket platform, if it's fixed you cannot change the height of your platform, working platform, respect to what are depth is call it is jacket platform. So, so these are generally anger on to the base.

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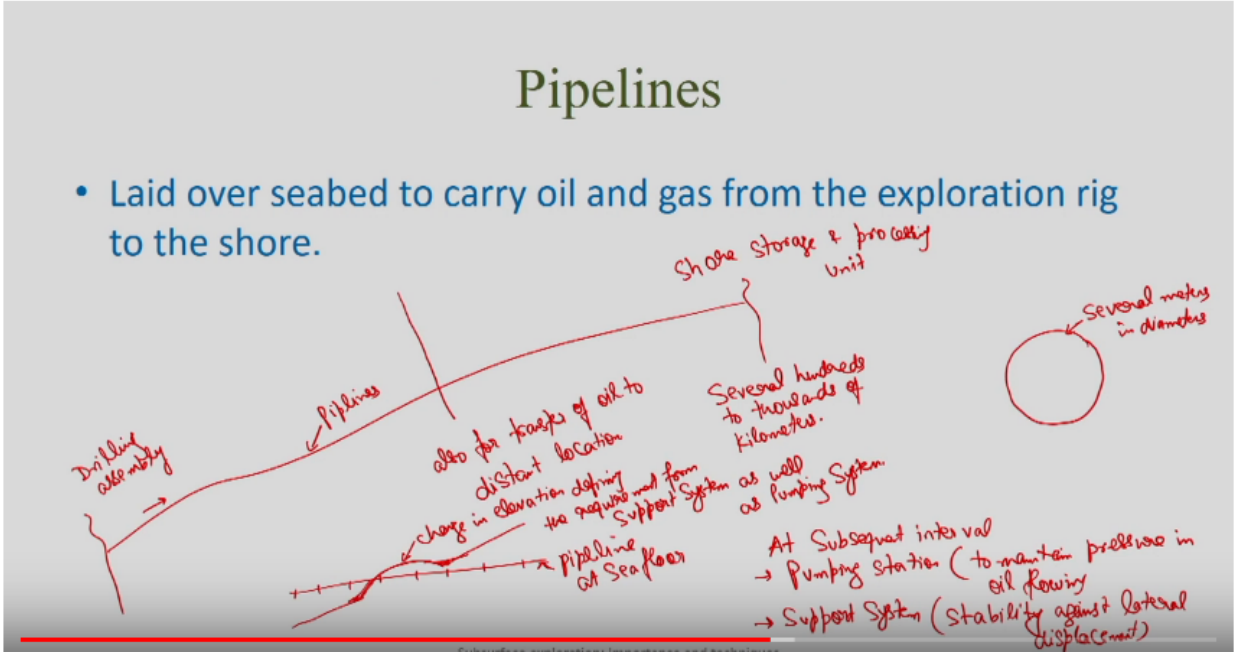

Then you're pipelines, which a generally it's discussed so, along sea flow you can actually sea pipelines running along sea floor like this. So, may we from drilling assembly, from where actually getting your oil seabed and then of shore, shore storage and processing unit. And you can for transfer of also for transfer of petrol or oil transfer of oil to distant location. So, this pipeline you can use it from drilling assembly, to storage of units also as well as transfer of oil, from distant location like distant country also generally, we see like particular country importing oil from other country. So, this is a generally we, we the country, dies transfer of are import, of oil other country, are the other country also transferring, I means also these pipeline, which may be are running for over several hundred are thousands are kilometres, several hundreds to thousands of kilometres. So, most of the portion if to country, a within between which transfer for highly sticky place it if is connect by landmark, with the again depend above on the relater distant between how much the landmarks, are if are to go through of, of sure what is a compression in team of cost what is a compression in team permission a required to, to arable pipeline, from land from are shore it, it generally decided running from several, hundreds to thousands of kilometres. This is pipeline so; I see is shoo-in, in, in team of the plan if you see the same think in team section this a pipeline we may be several meter, several meter in diameters will having pumping stationary different, different location also along pipeline because carrying, cured oil different location are processed oil generally kind of not comment practice. So, several mitres and die a meter and so, at subsequent at interval at subsequent at interval they are pimping station, to maintain pressure in pipe in, in oil lowing and in between at also you will having support system, support system, which primarily use for providing stability, against lateral displacement ,which like only support. They can we another condition like this pipeline, another pipeline is to pass so, this if you see it in, in plan it look likes to pipeline are processing easy other but if you see, may be in elevation you re see like one support system, while one pipeline is running along with the sea floor,

pipeline at sea floor, which a continuances interval anger at sea floor another pipeline, which passing pipeline glow to this. So, it will be like this and there, will be some change an elevation and then like this, like this change in elevation. So, that it can I mean it I mean in order to ensure the two pipeline are running smoothly, because your two provided pumping system considering this kind of change, your two provided support system also considering, this kind of change in the elevation in other pipeline. So, this called as,' Changing ', these a generally called as,' Support System Changing', elevation defining the requirement from, from support system, as well as pumping system. That are also be in and that is support it taken to the account when we talking, about pipe system.

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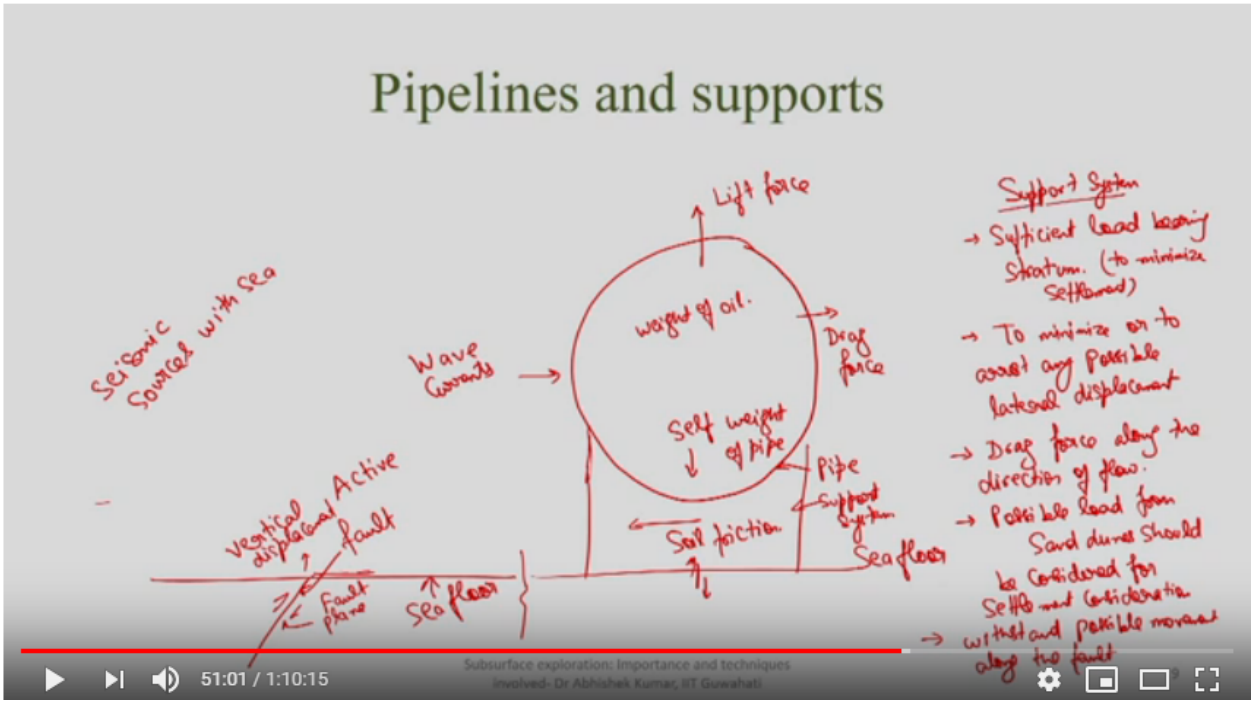

So, broadly you can consider as I mention here. The pipes are generally several meters and diameter in order, to provide support system, system the objective here is to provide sufficient, sufficient load bearing, load bearing stratum, secondary they are will be kind of, skin soil fiction between pile as well as, between the pipe as well as soil is available base, then they will be some kind of drag force, they will be some kind of wave currents, which are also pushing, the pi pipe then you having lift force. And then self-weight of the pipe to self-weight, in addition to and then you can consider maybe, depended about flow current also, weight of oil with that, because that is going to the review how much maximum allow weight, for which you to design your support system. You can consider this maybe sea floor. So, sea floor is the foundations are support system should provide enough load carrying capacity. So, that they should not be any kind of settlement to minimums are to settlement. And an then most important because of the drag force maybe because of the drag force should be like this because, of the water current there will be lateral fashion, to minims or to arrest any possible lateral displacement.

So, the support system again, one important, another important thing is, as I mentioned here, like the oil which is, within the pipe as to be, as to maintained constant pressure, so that did can be transfer to distance location, again there will be some kind of drag force along the direction of flow, for which also, you have to design your support system. Then another think is, in case of possible load from sand dunes, should have minimum affair or should be consider for settlement analysis, for settlement consideration. Next, we keep on the discussing like, when we go for exploration, another important aspect, of exploration is to find out possible, seismic sources which are available, seismic source is, within sea. Now what will happen? Because of those seismic source is, like supposes this sea area, a just give your an extension of this, suppose this is a sea floor, because of the presents of some fault here, or more specifically I can tell, it is an active fault. Active fault means, the fault which is, capable of producing in earthquake in the near future also, otherwise they can we an active fault, which, which are their, but, may not a cause any season given. Now, what will happen in case of an active fault an during an earthquake, what will happen there will be some kind of? A relative motion, between two parts of the fault, you can call it is like, 'Fault Plane One' you can call it is, 'Fault Plane'. So, because of this, they relative motion, what will happen? There will some of lateral, there will some of vertical lock, vertical displacement. So, most of the time it is, it is tried, to, to avoid, like the ling of the pipe line should be, a not a crossing this, any possible fault. But, if it is, crossing then the support system should be capable, should be design. So, is so that can withstand, withstand possible movement, along a fault, possible movement along a fault. So on, the relative motion between the fault, which is like this, so because of this relative motion what will be impact likes the fault, is here. So because of this, there will be some relative motion are disturbance, to the boundary, this might move up, this might move down, how, how this is going to control the stability of you pile, pile line foundation: that is going to be your, your support system for the pipe foundation should be design for those kind of, load and condition.

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Now, we discuss about, Artificial Islands. So, these are generally used and this consists of and offshore platform, generally used in shallow foundation, shallow water. So this is generally developed in terms of Cassion retained platforms. To do this the cassion is brought on to the site, where actually your interested to find out or create an Artificial Island, then you lower it, on to the sea floor and once it is, some can't to the sea floor, you can actually, fill it with the granular material so, so because of its salvate which is the salve great of the cassion plus the great of the filled up material, it will retained in

its position and that Saul, you can create an Artificial Islands, it can be for, again for communication give us or may be for pumping system, it can, it can be created like this or may be support is, in case of other the members, or offshore structures, can be used.

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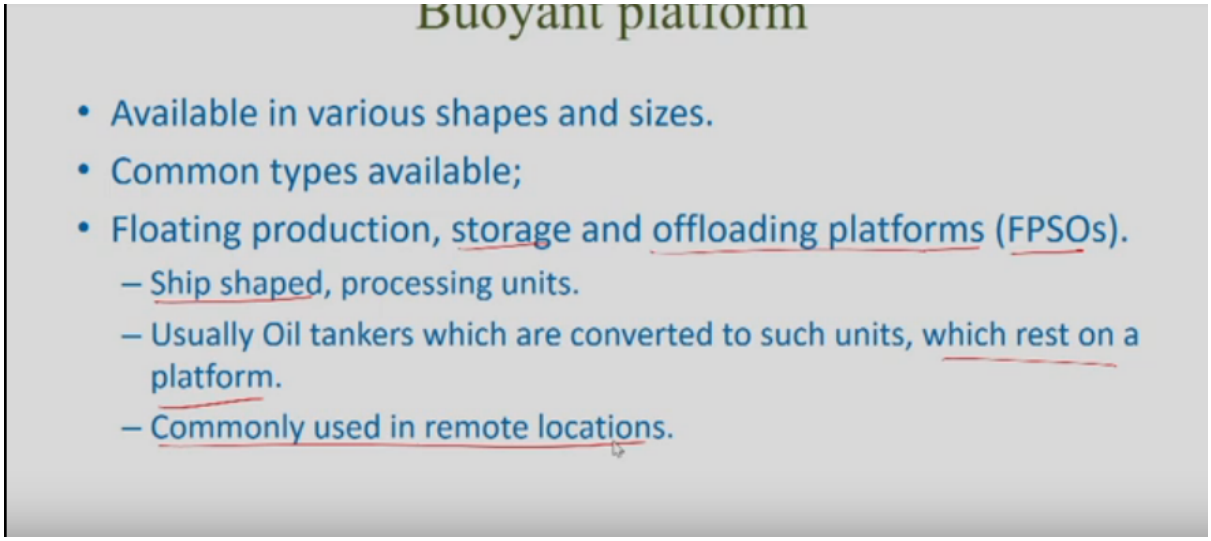

Now, this is about, those platforms which is either, faced or floating I mean, these are supported, by means of some systems, whether it is like truss, or it can be anchored system, whether it will be pile system. So, again this buoyant system, which is basically, floating continuously floating, with respect to your sea bed, so the what kind of, what kind of systems are possible? In case of offshore environment, so these are available in terms of various shapes and sizes depending upon the critical implication of these, so commonly, adopted are like floating types, which is also called as, 'Floating Production Storage Offload Platforms'. So, where your actually, exploring your actually drilling, or getting the oil, crude oil your actually storing it and then so these, these kinds offshore platforms are also, there we are your actually loading to, other platforms, for the transfer as storage of plat, the, the drill oil. So, these are generally, in the form of ships also called as, 'FPSOs' that is floating production, storage, offloading platforms. So, these are in the form of ships, also containing the processing unit, through which you can actually, get the storage. Then usually oil tankers which are converted to such units, which rest on a platform. So, you are having a small ship, on which you are having a tanker, which, which, which can I actually store, whatever production has been done for the all, we can actually store it. So, commonly used in remote locations. So, you can used these things in terms of remote locations.

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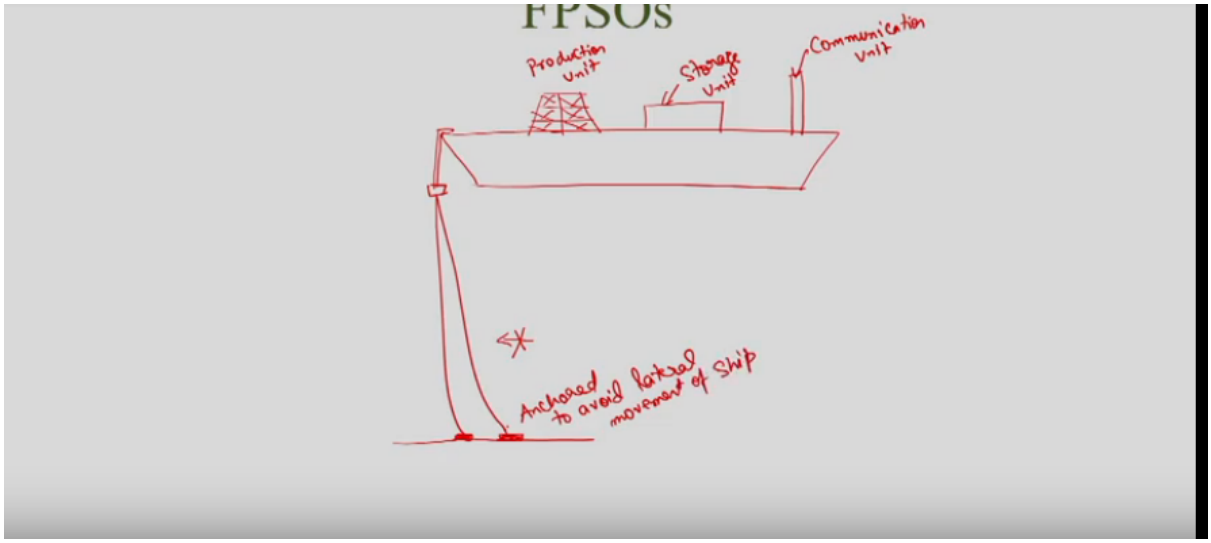

So, as I mention here, only thing like because, these are buoyant system, because these are particularly floating in the water, on the sea floor, so these, these like small vessels kind of things, which are having your drilling assembly also here, again in terms of steeled and tubes, in then you are having storage, tank here, this is like drilling assembly or production unit, production unit then this is called as, 'Storage Units' and then you can have communication unit also. But, as I mention here, these are supposed to be anchored otherwise, these will we told away by, by water current. So, this is like this and again it will be told, at two locations minimal, these may be, must be anchor and this your sea bed. So, this will pro, prevent any kind of lateral movement, of these kind of ships or a, a fear source, due to water current, so anchored to avoid, lateral movement basically, these are in the form of ships, so, one is the storage is done, when the production is done you can actually move to other location. To avoid lateral movement, of ship, then you are having

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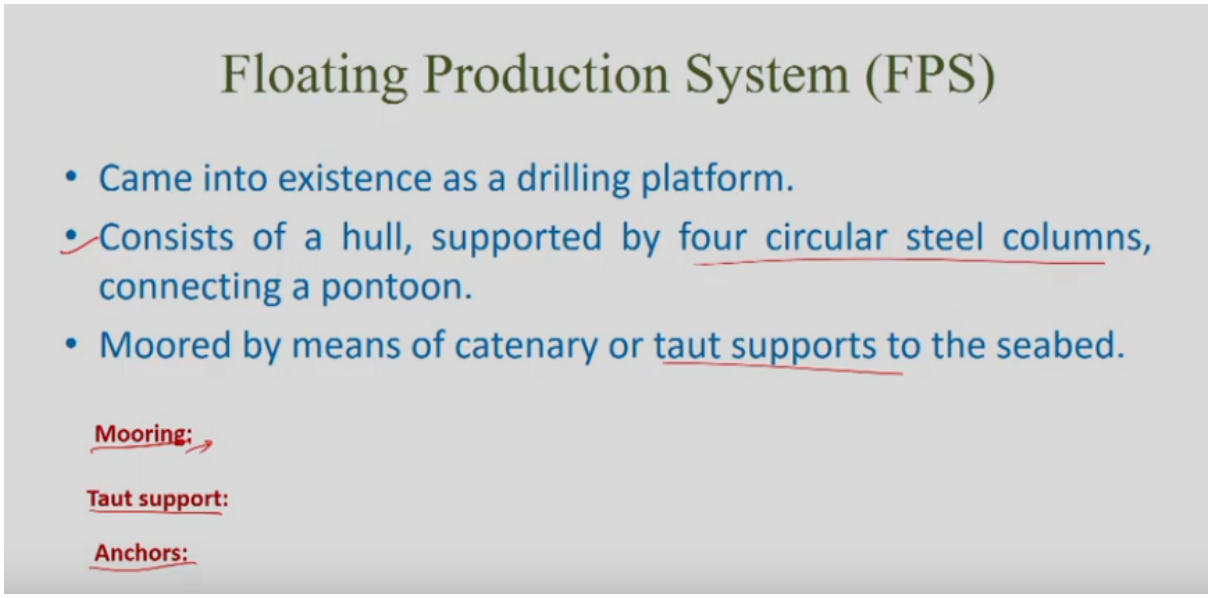

Another one, like floating production system that is called as, ‘FPS’, so these also came in to existence, as first of all people started using it as a drilling platform and then, later on with can be use us, anchored system for storage part also. So, again it consists of hull, which is basically, you can considered may be a stable platform on which, you can use it as a working platform may be for storage, may be for drilling purpose also, so this consists of a hull, supported by four circular steel columns, connecting a pontoon. So, four steel columns are there, which is connecting a pontoon, over that actually you can, you can actually rest a drilling platform. So, these are generally moved, by means of a catenary or taut system to the sea beds, so mooring is basically how, how your platform, which is your buoyant system or may be fixed system, how these system, because every system whatever you are going to place, in offshore environment has to be prevent for any kind of lateral displacement. So, as the system, which is particularly use for connecting? Your, your, your drilling assembly, your floating assembly with respect to the sea bed that, that, that phenomena is called as, ‘Mooring’ the process is called as, ‘Mooring’. So, this is done by means of catenary or taut support, so in catenary support you are having, some combination of ropes, as well as, a change, in taut system, again you are having a lybred ropes, we are going to discuss and then anchors of course, depending upon a water depth, depending upon the characteristics offshore buoyant medium, this anchor can be design for smaller load, it can be design for larger load and again depending upon water depth, it can be design for a vertical load as well as, lateral load or a combination of both.

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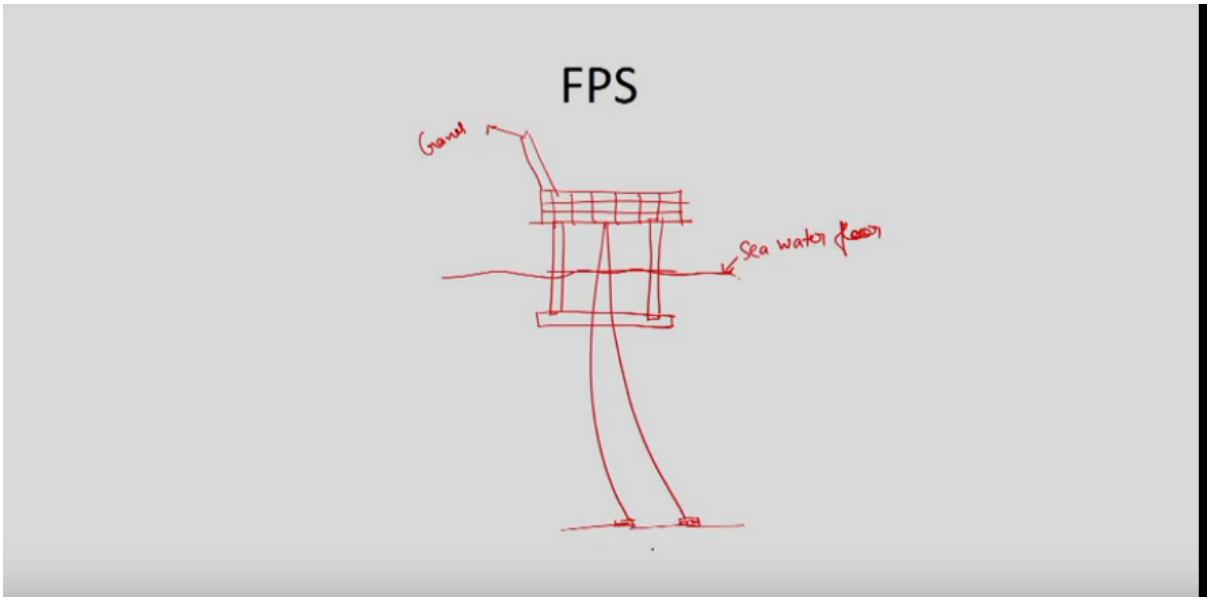

So, FPS is an mention here again, these are called as, ‘Floating’ so you’re having pontoon which as connected to your hollow skial tubes, this is your supporting assembly, which is basically floating and over this assembly you’re having a drilling assembly, storage assembly you can have a capable crane also, supporting cranes and this is basically anchors, so you can see here, suppose the water depth somewhere here, sea water floor and these are access in anchored on to the sea bed. So, this is called as, ‘FPS Assembly’ so unlike ship these are basically the drilling a ray units, which are of floating characteristics. So, this is called as, ‘FPS’.

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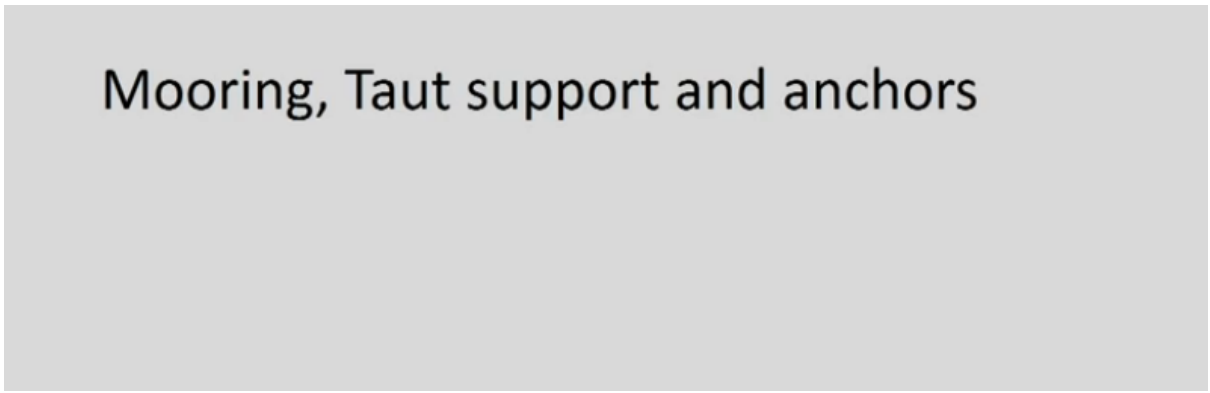

Then next one you're having mooring, taut support system and anchors, is I mention here, depending upon a kind of water and depending upon the water depth, depending upon what kind of load your targeting for, you can have difference support system, mooring systems and so on so forth.

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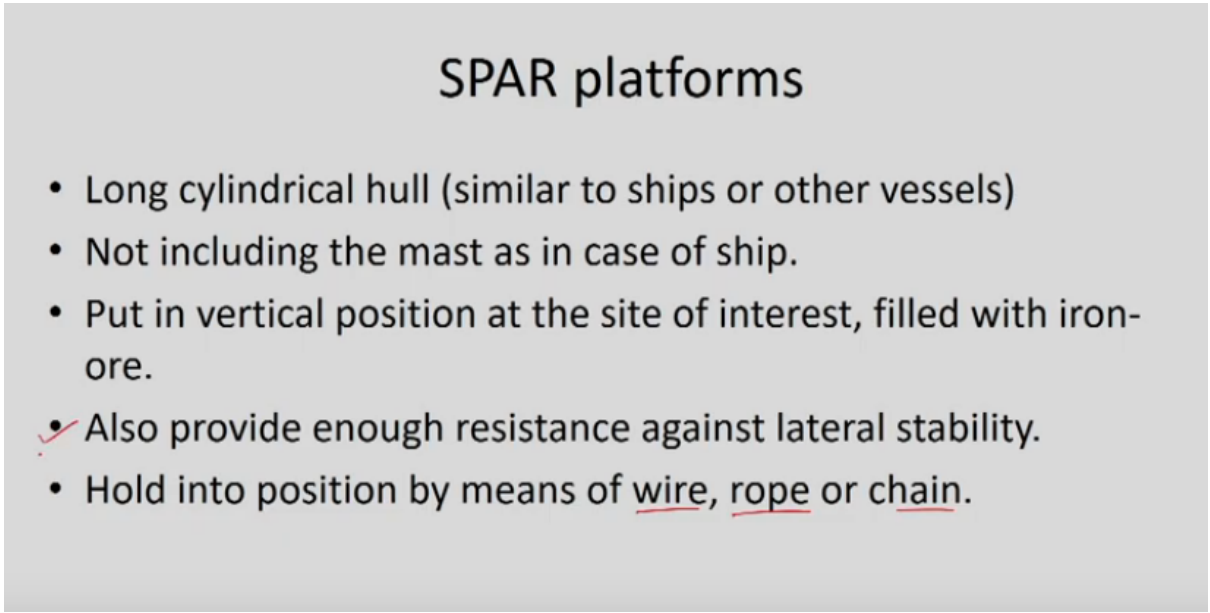

Then you can have spar system, which are a basically long cylindrical hull, similar to ships or other vessels, not including the mast as in case of ship. But, rest of the properties in terms of ship only. So, this is put in vertical position at the site of interest, filled with iron- ore. So that it will retained in its position and then you lower it, with respect to your, so these are vertical kind of ships, not with the mast, you can anchor it, on to your sea bed, by means of wire, ropes or chains. So that again it will not sure or they will not any kind of lateral movement, also provide in a resistance against lateral stability, by means of filling it with the iron ore.

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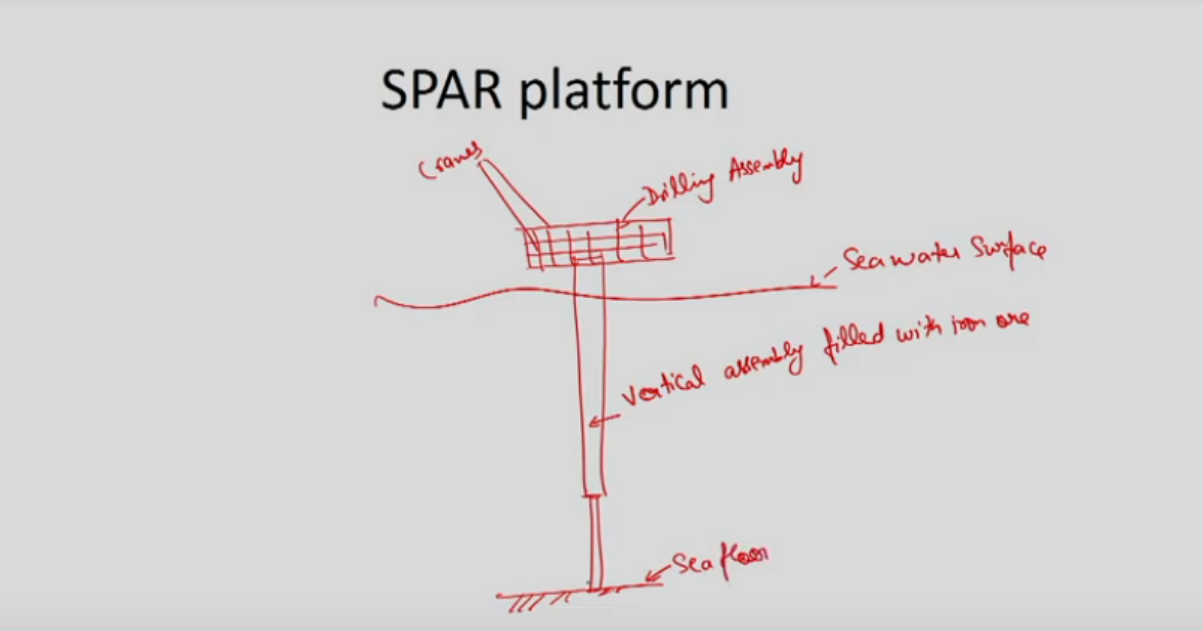

So, this is like again, this is a water, sea water, surface so this is your spar assembly, which is like vertical assembly like very much similar to a ship, this is your drilling assembly, then there are some cranes also. So, this is basically filled with vertical assembly, this is your vertical assembly filled with, iron ore. So, this provides lateral stability and again, these are provide by means of fix system on to the sea floor, so this is a sea bed or sea floor this is anchor, it is on to the sea floor.

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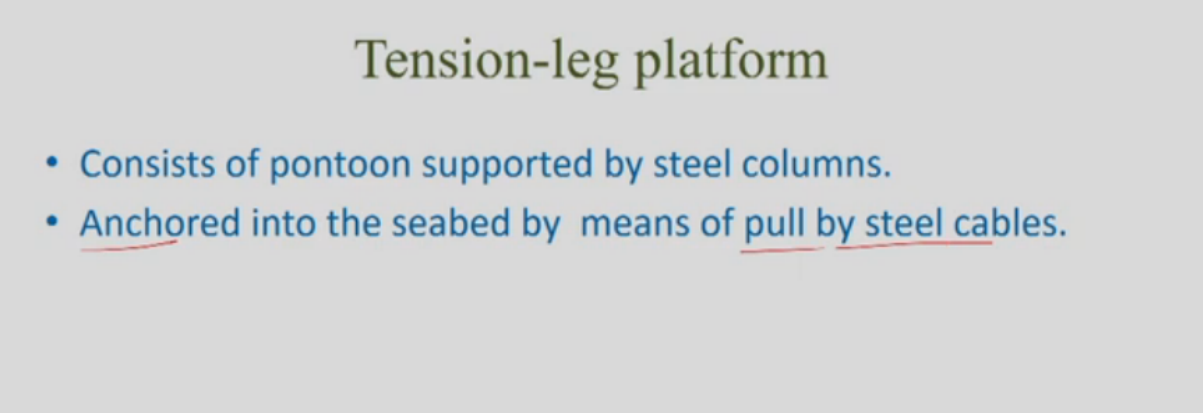

Then you can having tension – leg platform, which consists of again a pontoon, supported by the steel column, this is like depending upon different kind of, structure which can be used for drilling itself, but, depending upon water depth, depending upon arrangement which is used, to provide the kind of anchoring system against lateral stability, is different system have been classified, these are again, tension – leg platforms, which consists of pontoon, supported by steel columns, anchored into the sea bed. So, this is anchored into the sea bed by means of steel cables. By means of steel cables we actually provided, resistance to.

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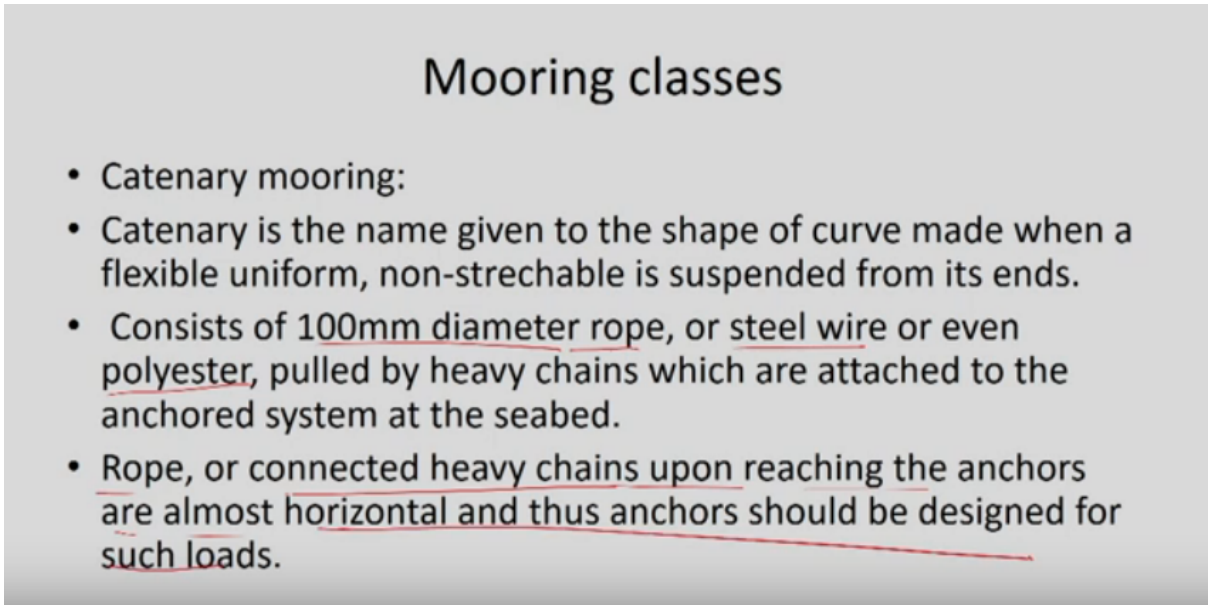

Now, mooring system as I mention, so mooring system basically consists of, the arrangement or assembly which is provided, so that the freeze platform or the, the floating system whether in terms of drilling platforms in terms of vessels, those can be captain in its position against any kind of lateral movement. So catenary movement, catenary mooring, which is the name given to shape of curve made when a flexible uniform, non- stretchable is, cable is suspended from is both the ends. So in this particular case, its consists of 100mm diameter rope, or steel wire or even polyester, which is pulled by a chain, so near your pontoon, a your hull, again it will be lower down, by means of a chain and another chain will be there at the sea bed and in between these two chain, there will be connection, by means of 100mm diameter rope, or steel wire. So, rope or connected heavy chains upon reaching the anchors are almost horizontal, because the chain as quitted, we so those become horizontal that is a reason by which the anchors which are provided, against which, which are connecting a surface unit which respect to sea bed or actually design, to withstand only horizontal loads, particularly in case of catenary mooring.

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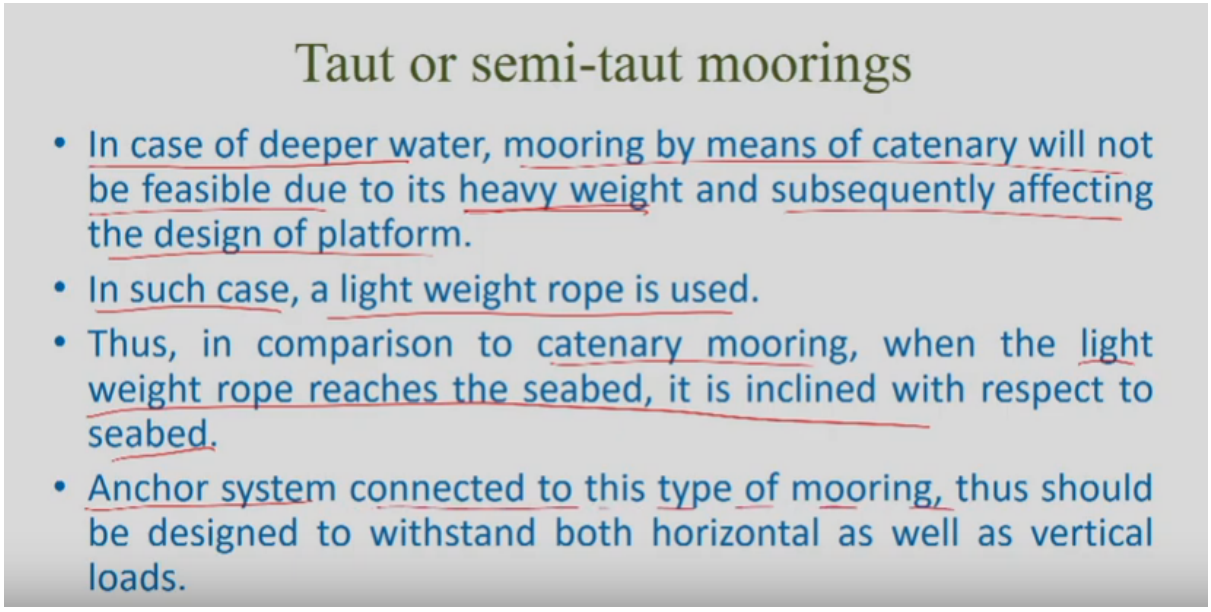

Now, if you come the taut or semi- taut moorings, what happen? When considering the water depth, considering the kind of surface assembly, if, if the water depth is too high, then the assembly, the corresponding the rope it will also, too high plus the chain weight. So, in order to minimize them particularly in case of deeper water, mooring by means of catenary will not be feasible due to its heavy weight and subsequently affecting the design of platform. Because the surface assembly also, should be strong enough, to withstand this particular weight, which keeps on increasing? With respect to the water depth, moor is the water depth; moor will be the weight of the chain plus rope. So, in such cases, you can use a light weight rope, but, only thing in comparison to catenary kind of mooring, when light weight ropes or connected with respect to surface assembly to the sea bed, these are basically reaching the anchors to its inclined, I mean it's, its reaching anchored, why disconnected anchored inclined had some inclination, what this reason? The anchored systems, which are provided, should be design to withstand both horizontal as well as vertical loads.

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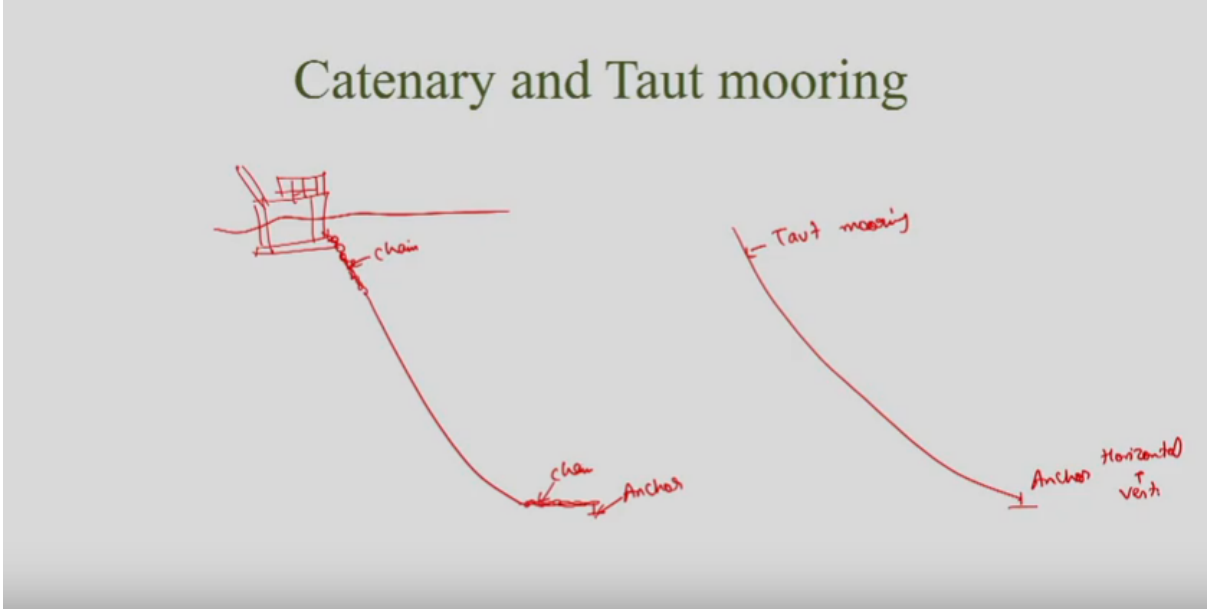

What I am went to say? Like an as in case of catenary system, in this is your assembly. So, if it is catenary system there will be some kind of change and then there will be some kind of rope and then, again there will be change like this and then again you will have your anchored system, so because of the salvate of the change before reaching the anchored system, it is become almost horizontal. However in other case, it will become almost like, this taut and semi taut, taut mooring so, your system of anchored should be design, to withstand both horizontal as well as vertical loads, thus vertical loads.

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Then vertical mooring and directly we can provided by means of steel pipe which are tension platform which, which can be embedded in to the seabed.

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Anchor system

- Provided to stability of the buoyant system against lateral displacement primarily due to water currents.
- Used both in case of fixed structured or flexible structures.
- Types:
  - Surface gravity anchors
    - Box anchor
    - Grillage and berm anchors
    - Embedded anchors
  - Anchor piles

Then anchor system, these are generally provided so that you can, you can actually fixed your support are, are you're a you can actually connect this system, floating system to your seabed. So, basically are of three types, box anchor.

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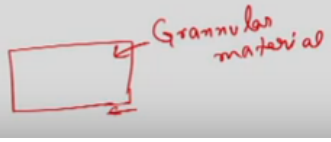
Surface gravity anchors

- Used as anchors in floating systems or to provide extra support for stability in case of fixed systems.
- Capacity is directly proportional to the weight of anchor and the friction develop between seabed and anchor base.
- Only restricted to shallow water depths because of limited size and capacity.



Box anchor, in this particular case, you're having a concrete box which is I mean, box which is filled with granular material and the anchor is provide its which will be against lateral movement of this, so depending upon the size of the block and depending upon its weights, its raise cans to a external loading will keep on increasing. The box anchors

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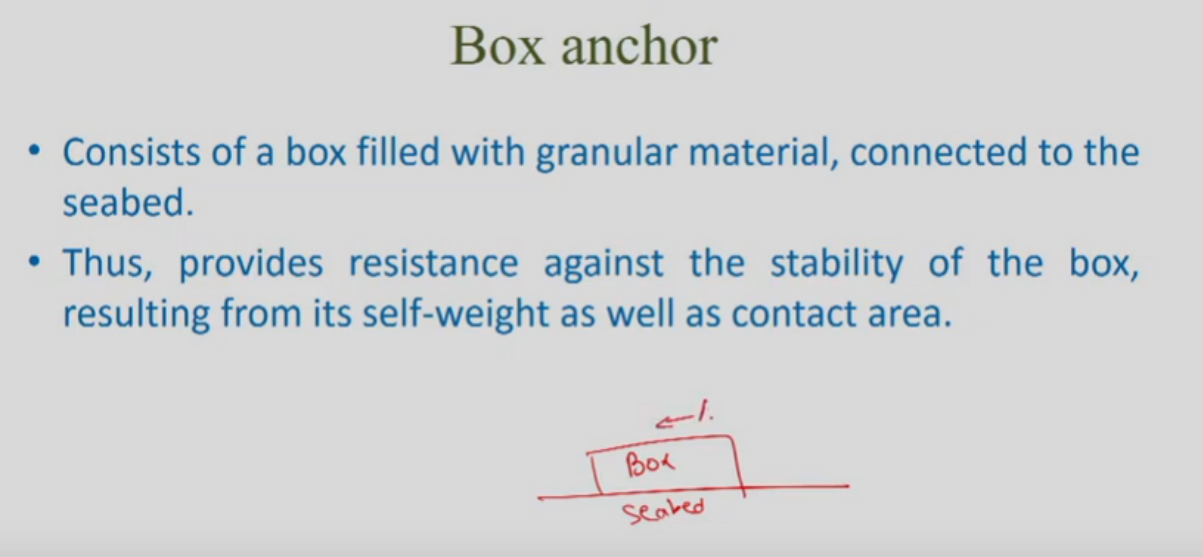

So, it consists of a box filled with granular material these provide resistance against, the stability of the box, but depending's upon the salvate of the box, depending upon how much is the area, because as the interface between the box, as well as seabed, larger is the area, larger fiction will be there against, any kind of lateral movement. So, it is providing resistance against lateral movement.

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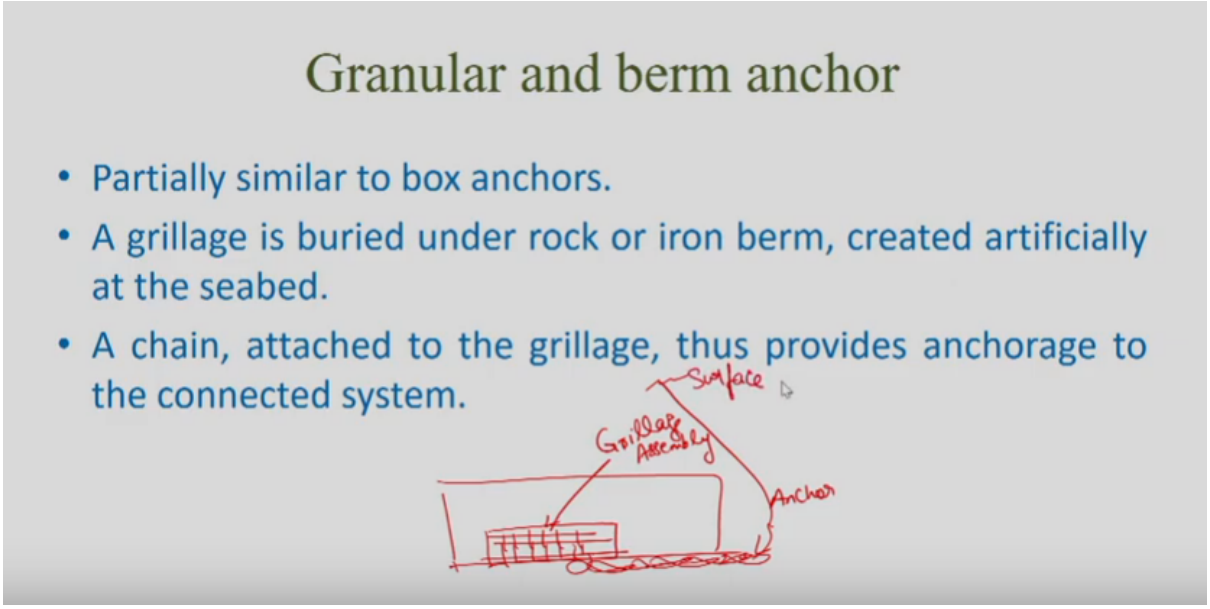

Other can be a granular and berm box in which a grill assembly is basically buried, under your box assembly; any chain by means of this is attached, which is use as a anchored system. So, this is your grillage assembly, against which, you're providing some kind of anchored system. So, a chain is attached to this, so this chain can be other again further connected with your surface assembly, depending upon what kind of mooring arrangement is there. So, you're having fixed platform, then you're having mooring, then you're having anchored system.

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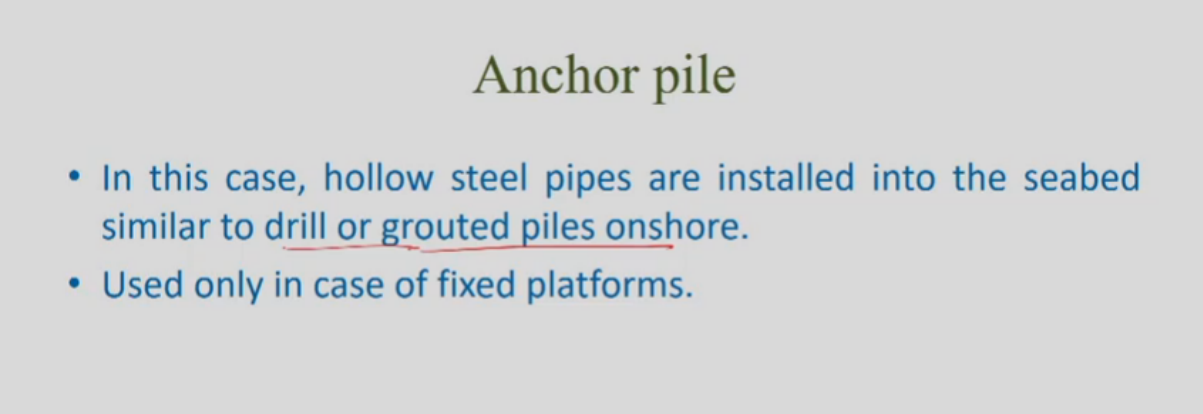

And then anchor system; anchor piles are the in case, hollow steel piles, which can directly transfer, which are particular use, in case of fixed platform, which are transferring load, from the structure directly on to the seabed. So, this can be done, by means of vertical hollow piles, which are grouted or, or anchor to the seabed, where he must similar to your, drill or grouted pile as in case of onshore structures. So, with this, we come to on today's presentation, I hope today presentation as given you some inside about, different kind of platform, which are used in, offshore environment, more process actually with respect to gas and oil exploration, second thing when, how these platforms can be connected to the seabed, depending upon the load the relative size and depending upon wave currents, in a particular location, third thing and most important thing which will also, define the stability of your mooring system, is your anchor system. So, depending upon the water depth, depending upon the, the characteristics of your mooring assembly, depending upon the characteristics of your platform, supporting platform, your anchored system, as to be design, the ideal conditions should be like the minimal distance should be as do as possible. So, with these we come to an and of today's class as well as the module for offshore investigation. Thank you so much.