Soil and Water Conservation Engineering

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Lecture - 41
Drop Inlet Spillway (Contd.)

Hello, good morning, just now we are going to cover the next part of the design of Drop Inlet Spillway. So, we will going to continue with more design problem here in these slides.

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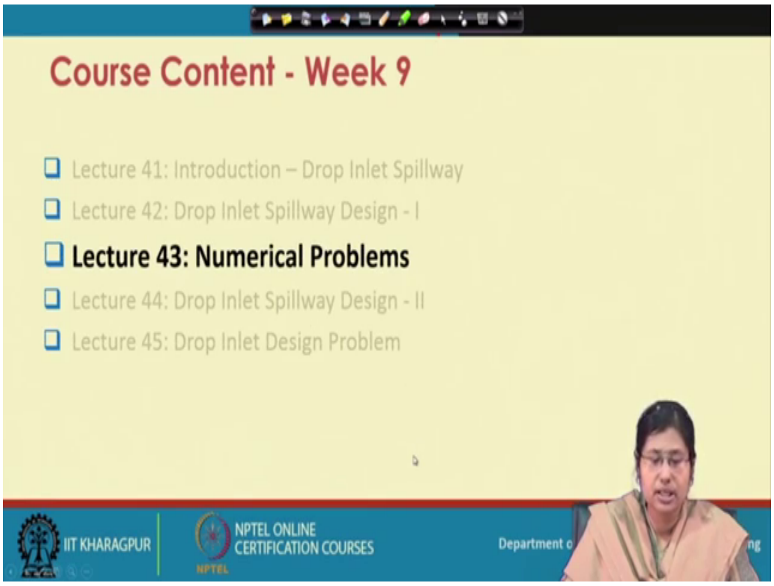

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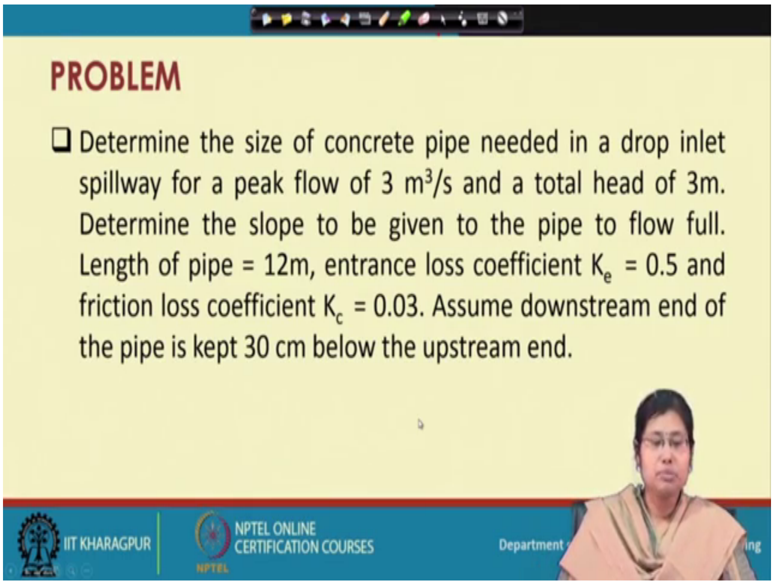

So, the problem number 1; so, determine the size of concrete pipe needed in a drop inlet spillway for a peak flow of 3 metre cube per second and a total head is assumed as 3 meter. So, determine the slope to be given to the pipe to flow full. And the length of the pipe is kept as 12 meter, the entrance loss coefficient is 0.5 and the friction loss coefficient is 0.03. So, assume the downstream end of the pipe is kept around 30 centimetre below the upstream end.

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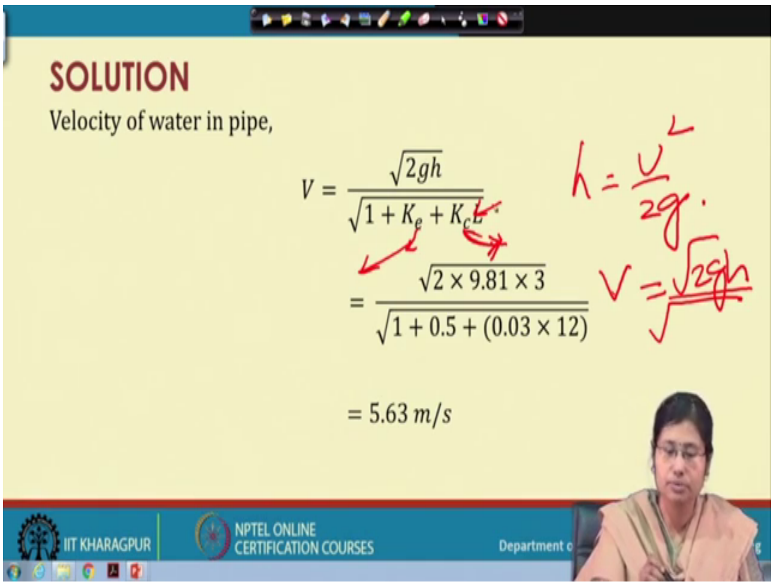

So, first we are going to calculate the velocity of flow in a pipe. So, this equations was already covered in slide number in earlier slide. So, here the velocity of flow is again a function of the coefficient of contraction and the coefficient at head loss at the entrance of the pipe. And this is again as you know this head the velocity head is a given by equation h equal to v square by 2 g. So, it is nothing but v equal to 2 g h, but since it is a pipe flow, so we are this is the losses due to pipe flow; so this factor is considered here. So, where K e is the head loss at a entrance, K c is the head loss due to the coefficient of contraction and L is the total length of the pipe. So, using that we can calculate the directly the velocity of flow through the pipe.

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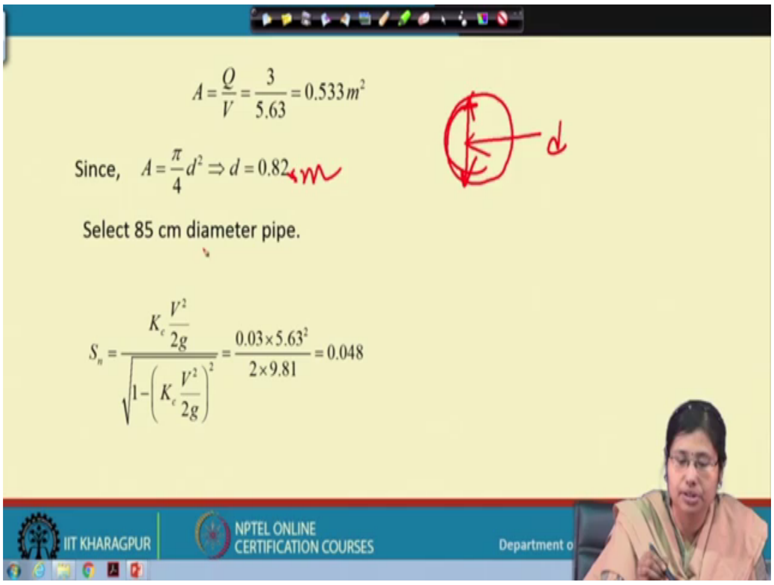

Now, as you know the area is a function of the cross sectional area of the pipe is the function of the discharge and the velocity of flow that we calculated in the previous step, so, this one. So, from there we can directly calculate the pipe diameter. So, since the pipe the cross sectional area of the pipe is seemed as circular. So, this is the circular cross section. So, the diameter of the pipe is calculated using a taking into care that is this is a circular cross section. So, here it comes the diameter of the pipe as 0.82 meter, so which is nothing but 85. So, since this is a not a standard measure, so we select 85 centimetre of the pipe diameter.

Now, we are going to compute natural slope. So, natural slope is again a function of coefficient of contraction and the head loss the velocity of velocity head. So, from that we calculated the natural slope of the pipe.

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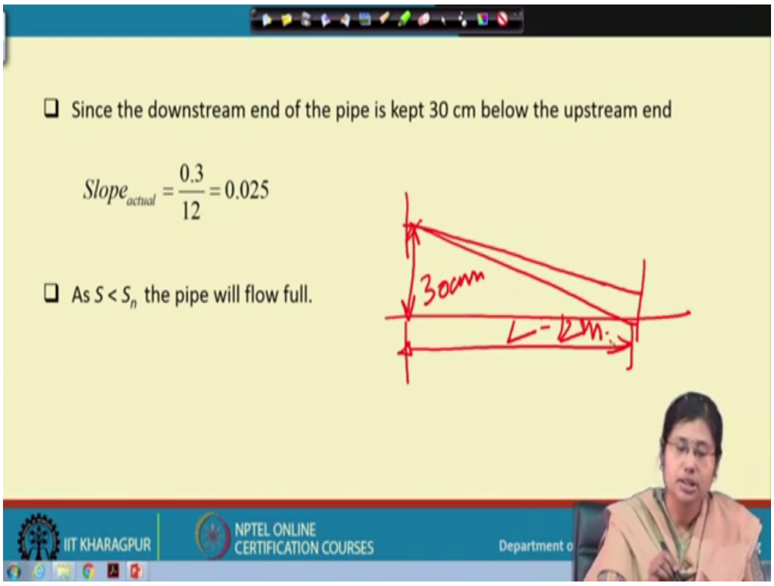

Now, as you have given the downstream and end of the pipe is kept 30 centimetre below the upstream. So, from that information we can directly compute the actual slope. So, here so this is in this way the downstream end is located at this is the downstream end suppose and the upstream end. So, this is located at a height of 30 centimetre. And this is your the length of the pipe suppose. So, this is the pipe length which is given as 12 metre. So, from this you can directly calculate the actual slope. So, thus actual slope is 0.025. And as you can see from the earlier slide, the natural slope is kept as 0.048. So, the natural slope is larger than the actual slope. So, this is the case of the condition 2 where the pipe will flow full.

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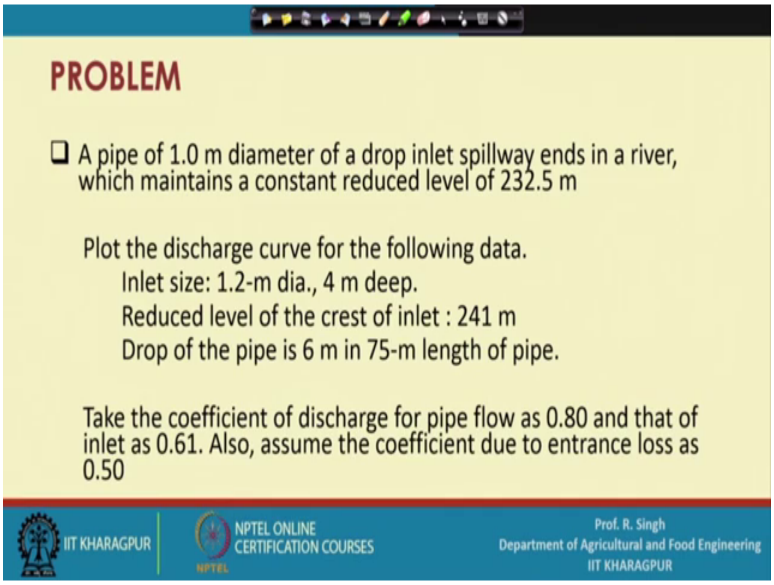

Now, coming to the second problem; a pipe of 1 diameter of a drop inlet spillway ends in a river, which maintains a constant reduced level of 232 meter. Now, this is a graphical kind of problem. Now, plot the discharge curve for following data. So, inlet size is 1.2 meter diameter and 4 meter deep. And reduced level of the crest at the inlet is 241 meter, drop of the pipe is 6 meter in 75 length of the pipe.

So, assume necessary data. So, some of the data is given as the coefficient of discharge for pipe flow is 0.80 and coefficient of discharge at the entrance is 0.61. And also assume that the entrance coefficient at loss is 0.50, the K e; it is kept as 0.50.

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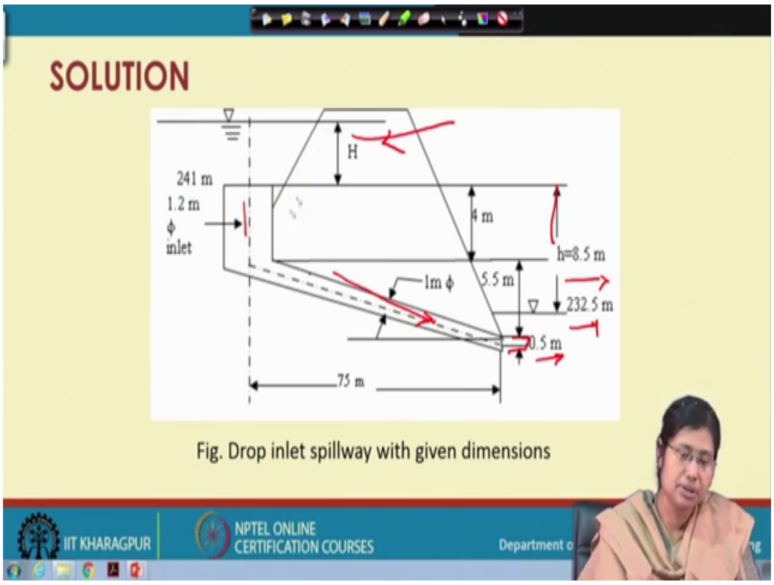

Now, this is the complete figure. So, this is kept as 241 meter and the diameter of the here the entrance is 1.2 meter. So, this is at a pipe structure is here, the diameter is sorry the pipe structure at here the diameter is kept is reduced 1 meter and this is the here the depth is around 0.5 meter. So, this is the 230 this is this height is the combination of 8.5 and 232.5 meter. So, this end is here, it located the dam and in besides the dam this spillway is kept.

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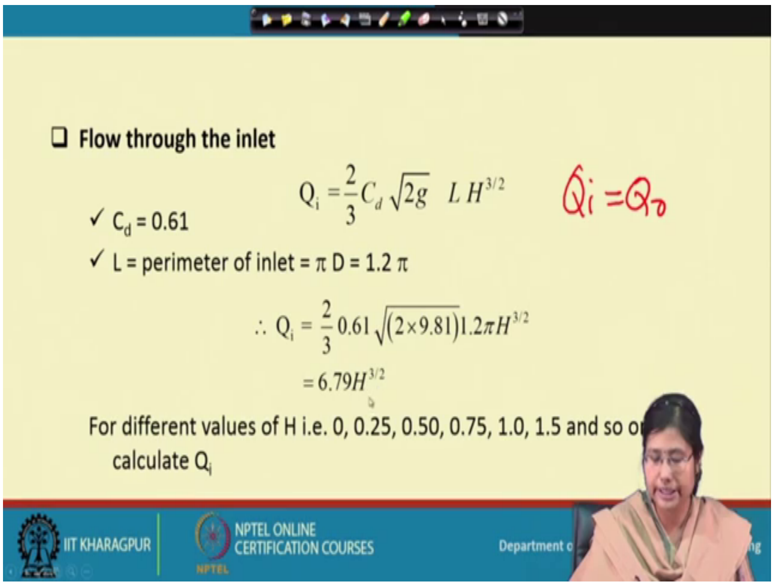

Now, how we can the first part as you can see, so this is the diameter at the inlet is given here. So, based on that first we calculate the flow through inlet. So, this is the flow through inlet as you all know is governed by weir flow. So, this is a weir flow equation. So, where, C d is the coefficient of discharge and the length of the.

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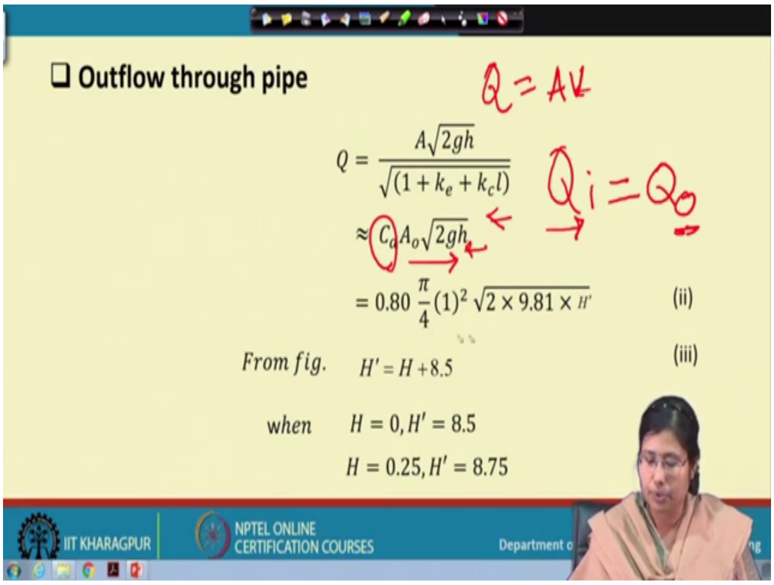

So, length of the pipe and H is the velocity head. And the discharge C d is given the coefficient of discharge is 0.61. And L, how we calculate the L? The length is calculated as the perimeter of the tube of inlet. So, the perimeter of the circular cross section is nothing but it is a function of diameter of the pipe multiplied by the pi.

So, using that you can get a Q i is a function of H. Now, for different values of H that is a different interval like at a interval of 0.25, you can get the calculate the value of Q i that is Q i is nothing but the flow at the inlet. Now, for to maintain the principle of continuity the flow of the inlet is equal to the flow of the outlet, the principle of to kept constant mass and momentum energy equation; so, Q i in this case Q at outlet. So, the flow at the outlet is nothing but the discharge is a function of area cross sectional area which is we assumed as circular cross section of the pipe multiplied by velocity and to conserve the principle of mass, momentum and energy, so Q i is equal to Q 0.

So, now, this Q is calculated as this one. And since the flow is very high, so we assume that this is called as a coefficient of discharge multiplied by cross sectional area and flow at the velocity. Now, we can directly compute, so the discharge coefficient of discharge is given by C d which is in the problem is 0.80. And now, it is since the pipe has circular cross section, so it is nothing but pi by 4 d square and then you get a value of H dash. So, now, Q i equal to Q 0 sorry. Now, so, you can equate the equation 1 that you already calculated in step 1 and equation 2 and then at various values of Q i a table value can be prepared.

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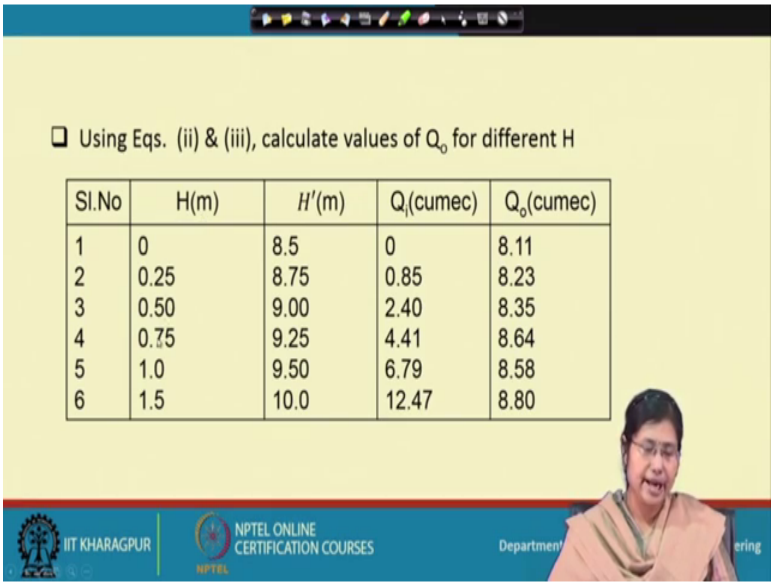

So, that exactly was performed here. So, at different head value and suppose H equal to 0, the value of Q i and Q 0 was calculated and then you can plot it graphically for different H values.

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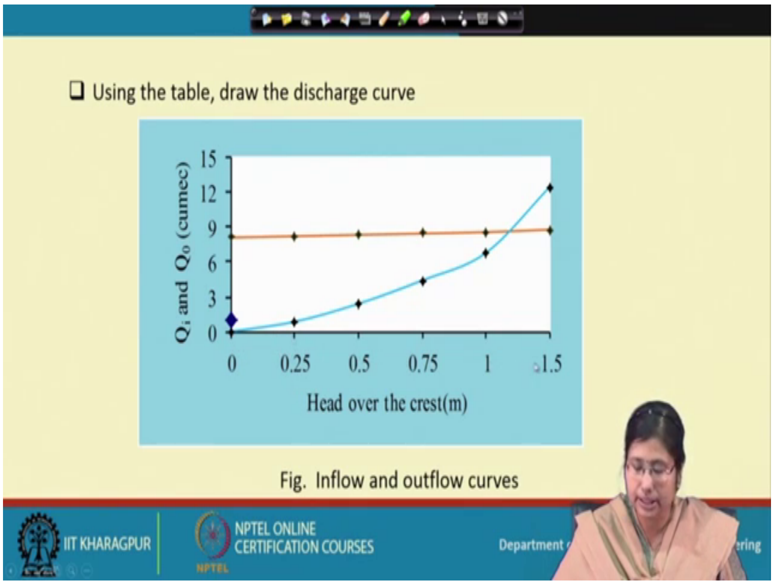

So, head over the crest. So, this is head over the crest at different interval. And what will be the value of Q i and Q 0 in cumec it is plotted here. So, as you can see the Q i here is the inflow at inflow is giving a parabola shape more or less parabola shape, where the outflow is generally a straight line or it kept more or less constant, where the inflow is maintaining a parabola shape. So, this is a inflow and outflow curves of the drop inlet structure. So, with these two problem I am going to end this lecture and.

Thank you.