MARINE ENGINEERING

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Lecture10

Concept of Resistance

So, concept of resistance. So, we have seen Q equals minus K A, we have seen K A delta T by L. This is a simple formula for heat conduction equation. But this can be similar to your electrical conductivity also. So, electrical analogy if you say I equals E by R. E is your potential difference or voltage difference, potential difference. difference, I is a current, electrical current, R is resistance.

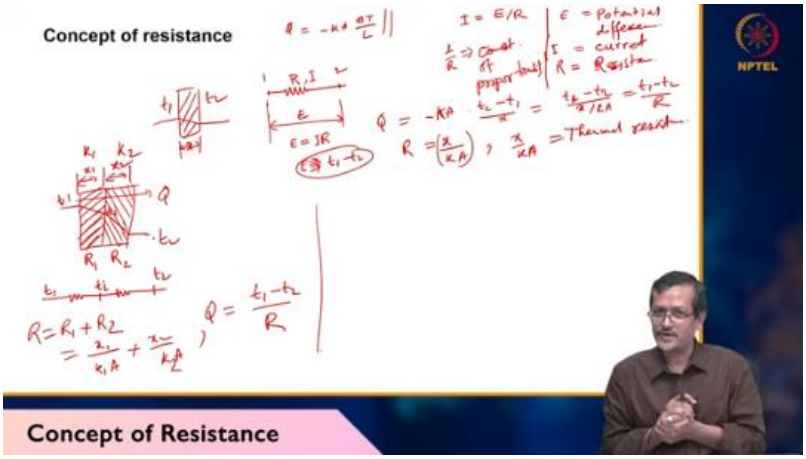
Now, 1 by R is called constant of proportionality, constant of proportionality. Now, how it will look like when we draw electrical circuit, we draw resistance like this R 0.1 to 0.2 and we are applying potential difference E and current moving I, so E equals IR. minus k a t 2 minus t 1 x okay i have one slab t 1 t 2 okay t 1 minus t 2 actually my potential difference okay uh e i can write t 1 minus t 2 This is potential difference actually, you can say equivalence if I make and slab thickness X. Now, x by k t2 by x equals t2 minus t1 t1 minus t2 this minus sign absorbing x by k a so i can write t1 minus t2 by r r can be equal to x by k a okay this is called thermal resistance so i can say x by k a

thermal resistance. Now, if I have two slabs, instead of one slab, I took two slabs, two slabs or two metal, iron and copper maybe. okay to metal so I'm say here for engineering drawing simple when two metals we are drawing so we'll be putting different hatching otherwise we'll be looking at same metal okay different hashing line okay do you want temperature here T1 temperature and T2 temperature here so it will go like this temperature may be different conductivity or different thickness okay this is resistance R1 as per electrical analogy R2 this is X1 X2 and heat transfer is happening Q okay if Q is input same heat must be output because energy must be conserved.

So, in electrical energy, how can I write? T1, T intermediate maybe and T2, T intermediate. So, R1 plus R2 are electrical energy. So, here in my heat transfer system i can write like

this x 1 by k 1 this is maybe k 1 this heat conductivity this is k 2 heat conductivity a plus plus x 2 by k a 2 a okay and q equals t 1 minus t 2 by r

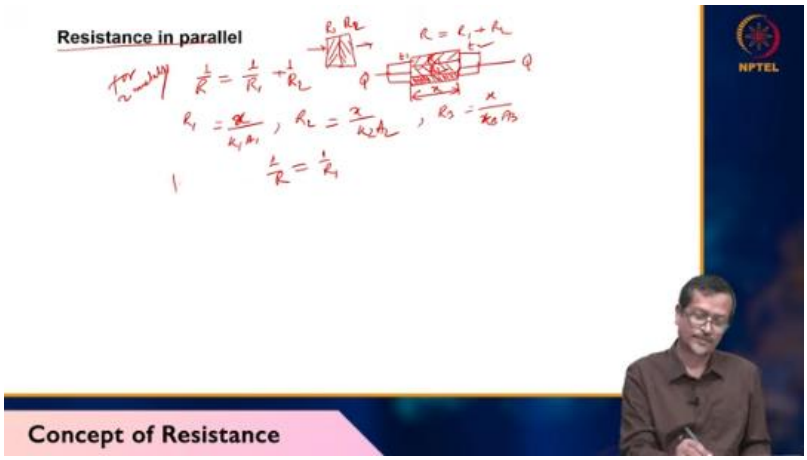
okay very simple uh two slab we are assuming same area if area is different then a also will be different but this is called electrical analogy so if i have many metals like iron steel copper and many metal in series you have connected especially this this formula is useful where you have insulator you have metal pipe you have one insulator how to calculate heat so you know in internal heat you know external heat and your resisting heat transfer so internal how much heat is there you do not need to know you need to know your k value this one k value this one area this one area this one based on that you can calculate actually heat flow rate okay resistance in parallel in series you have seen heat transfer rate like electrical analogy you have seen R 1, R 2, R 1, R 2. So, R becomes R 1 plus R 2. So, similarly, if I have two metal in series like one is here, another is here and heat is coming



Q heat, same heat will be going out and R1 resistance is here, R2 resistance is here, temperature T1, temperature T2 and this distance is x. So, formula becomes R1 by R1 plus 1 by R2. So, r1 equals x by k1 a1, r2 equals x k2 a2. And if I have another slab also, I can write like this. So, if I have three slabs, so in that case, I can write like this R3 equals X by K3 A3. So, I have to make difference in hatching line also, because three different metal I am assuming.

So, in that case, my formula will be modified as 1 by R equals 1 by R1 for two metals. for three metals okay 1 plus r 2 1 by r 3 okay

Resistance in parallel



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