

MARINE ENGINEERING

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Lecture6

Basic mode of heat transfer

hello and welcome to the course marine engineering today i will start the course on the topic heat transfer so heat transfer phenomena is happening in many places in in and around your life and in your marine engineering system also so basic topic i'll be selecting from kc nag the nag book basic and applied thermodynamics not casein this is pk nag and any standard textbook on heat transfer will be okay for this study because this is basic heat transfer thing i'll be discussing the heat transfer will be used for many places in your engineering system for example you have one heat exchanger in a boiler system you have heat exchanger in your refrigeration system you have heat exchanger in your nuclear power plant system or gas turbine system so there will be several heat exchanges or heat transfer area where you have to consider the material maybe maybe you have to resize the whole system or you have to when you are designing a naval ship so that time you have to give certain space for placing your heat exchanger system you may have to design for cooling water system or you have to heat room during winter season

so there are multiple uses of heat transfer theories in your marine engineering or marine or ship systems So, in this week, I will discuss about different modes of heat transfer, how to calculate if you have one pipe, you have any solid wall, how heat will be transferring from one point to another point, what is the temperature gradient, I will be discussing regarding electrical analogy and I will be discussing about heat exchangers. Heat exchangers are commonly used in your systems such as refrigeration system, it is used in your bikes it is used in your marine engineering systems and many many applications are there so I'll discuss around two and a half and three hours this week different mathematical calculation different modes of heat transfer different mechanism of heat transfer okay so basic mechanism of conduction so conduction means like you have solid body and if you heat one end heat will be transferred to other end

if it is metal let's say iron or copper or aluminium it will have very high heat conductivity so because of heat high conductivity this one end if you heat slowly heat will be going to the other end okay this is going through a solid body and it's called heat conduction okay and heat is conducted because of molecular resonance whenever whenever you are heating a body molecule will be resonating at a higher rate okay that resonance will be transferred to another molecule another molecule another molecule so this way molecules will be transferring heat to other end of this metal object okay this is the basic principle of conductive heat transfer now in convection heat transfer in conduct actual molecular motion will be there in conduction you see molecule resonance was there and that resonance you transferred but molecules did not move from one point to another point but in convection heat transfer what happens molecule will be transferred molecule will be taking heat it will be physically moving to another place okay and cold fluid will be coming to that hot area again it will be getting heated up it will be moving to the another place so that way convective heat transfer will be occurring okay and radiation radiation heat transfer is occurring from sun to earth heat is coming through radiation radiation means it does not need any medium in vacuum also it can travel again when it is traveling through any medium like say air so from sun to earth heat is coming but is not heating up the air okay it is sitting up directly earth surface okay so the medium will not get heated up because of radiation and the formula like In previous week, I have discussed about different scale of temperature.

We have seen Celsius scale, Fahrenheit scale, Rankine scale, Kelvin scale. So, this formula you have to remember $K = C + 273.15$ Kelvin. $C = \frac{5}{9}(F - 32)$ so if i give any temperature in centigrade or fahrenheit or rankine you can convert to other scales okay so this is basic formula although although i have told in previous uh week but again you should remember this one so heat transfer examples are ic engine in your marine engineering system engine, then you will have boiler system where heat transfer calculation we have to do, IC engine we have to do heat transfer calculation, air conditioner you have, refrigeration and air conditioner, I will not write AC, otherwise you should not say it is bank account, it is air conditioner or refrigerator. Okay, there also heat transfer system will be there, heat exchanger will be there, we have to calculate.

And in air conditioning system, many times heating, ventilation, air conditioning we say. So, if cold winter, cold weather you are facing, for example, you are traveling to Alaska, temperature is very low. So, in that case, you have to heat the room to make it comfortable

for the passengers. You are transporting natural gas, CNG, compressed natural gas. So, you have to maintain certain amount of temperature.

Your engine is producing lots of heat that heat must be dissipated so lots of work you have to do with the heat how to dissipate some time how to increase it sometime because heat is your power okay so that power should be used properly misuse means that can be dangerous and if you are using properly that will give enough efficiency in your system and low cost marine propulsion system you can design you can generate or you have to design a compact marine uh ship machinery systems

W2: Heat transfer

- Book:
- K.C. Nag, Basic and Applied Thermodynamics, TMH
- Any standard text book on Heat Transfer.

<https://www.ndtv.com/india-news/dehi-cold-dehi-cold-wave-north-india-cold-wave-cold-wave-in-dehi-for-next-3-days-temperature-may-drop-to-3-degrees-3896473>

Basic mode of heat transfer

- Conduction – HT between molecules
- Convection – HT due to movement of particles.
- Radiation – HT through a medium or vacuum, space is not heated up.

$K = C + 273.15$
 $C/5 = (F-32)/9$
 $R = F + 460$

- K Engine
- Boltz
- Air Condition
- Refrigerator

