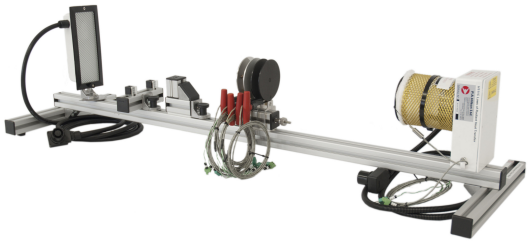
LAWS of RADIANT HEAT TRANSFER/HEAT EXCHANGER MODULE

H112C



Year 1
study

Description

The Laws of Radiant Heat Transfer and Radiant Heat Exchange allows the basic laws of heat transfer by radiation (both heat and light) to be investigated. Two appropriate detectors, light filters, target plates of different Emissivity and aperture plates each mount on suitable carriages on a parallel graduated track, and allow simple and rapid experimental procedures. The electrically heated matt black radiant heat source is fitted with an integral thermocouple to record its surface temperature. A radiometer detects the heat flux directly in W/m2 from either the source, a combination of four plates of different Emissivity (two matt black, one grey and one polished) or between a slot formed by two moveable cork faced plates. Each plate of different Emissivity incorporates a surface thermocouple for temperature measurement. The diffuse light source comprises a low voltage filament lamp within a rotatable enclosure (180º) that can be located on the parallel track in place of the heat source. A lightmeter recording directly in lux may be located in place of the radiometer in order to measure incident intensity. Supplied filter plates of varying opacity and thickness can also be mounted on the track to demonstrate the laws of light absorption. All six thermocouples plug directly into the Heat Transfer Service Unit H112. The radiometer and light meter plug into an auxiliary console that is integral with the H112C demonstrator. Both the heat source and light source intensity are controlled through the variable 240v ac supply from the Heat Transfer Service Unit H112.

Related Laws/Applications

- Radiant Heat Transfer
- Radiant Heat Exchange
- Inverse square law for thermal radiation
- Stefan-Boltzmann Law
- Kirchhoff's Law
- Inverse square law for light
- Lambert Cosine Law for light
- Lambert’s law of absorption

Learning capabilities

- To show that the intensity of radiation on a surface is inversely proportional to the square of the distance of the surface from the source of radiation (To demonstrate the inverse square law for thermal radiation)
- To show that the intensity of radiation varies as the fourth power of the source temperature (To demonstrate the Stefan-Boltzmann Law.)
- To show that the intensity of radiation measured by the radiometer is directly related to the radiation emitted from a source by the view factor between the radiometer and the source.
- To determine the emissivity of radiating surfaces with different finishes, namely polished and grey (silver anodised) compared with matt black.
- To demonstrate how the emissivity of radiating surfaces in close proximity to each other will affect the surface temperatures and heat exchanged.
- To determine the validity of Kirchhoff's Law, which states that the emissivity of a grey surface is equal to its absorptivity of radiation received from another surface when in a condition of thermal equilibrium.
- To demonstrate that the exchange of radiant energy from one surface to another is dependant upon their interconnecting geometry, i.e. a function of the amount that each surface can see of the other.
- To show that the illuminance of a surface is inversely proportional to the square of the distance of the surface from the light source (To demonstrate the inverse square law for light)
- To show that the energy radiated in any direction at an angle with a surface is equal to the normal radiation multiplied by the cosine of the angle between the direction of radiation and the normal to the surface (To demonstrate the Lambert Cosine Law for light.
- To show that light passing through non-opaque material is reduced in intensity in proportion to the thickness and absorptivity of the material (To demonstrate Lambert's law of absorption).

Technical Specification

- Heat source: 200W ceramic heater; Ø100mm black plate (Near 1.0 emissivity)
- At maximum voltage plate can reach upwards of 300°C
- Light source: 40W bulb, glass diffuser. 180° rotation

Essential Ancillaries

- H112

What's in the Box?

- 1 x H112C
- 1 x Spares set
- 1 x spanner
- Instruction manual
- Packing List
- Test sheet
- Wiring Diagram

Weights & Dimensions

- Weight: 12.4 kg
- Length: 1230mm
- Width: 300mm
- Height: 440mm

Essential Services

- H112

Ordering information

To order this product, please call PA Hilton quoting the following code: H112C

All brand and/or product names are trademarks of their respective owners. Specifications and external appearance are subject to change without notice. The colour of the actual product may vary from the colour shown in the brochure.
Copyright © 2018 P.A. Hilton Limited. All rights reserved. This technical leaflet, its contents and/or layout may not be modified and/or adapted, copied in part or in whole and/or incorporated into other works without the prior written permission of P. A. Hilton Limited. Hi-Tech Education is a registered trade mark of P. A. Hilton Limited.
COUNTRY OF ORIGIN - UK WARRANTY PERIOD - 5 YEARS