MEDICAL THERMOGRAPHY

- Thermography is the science of visualizing these patterns and determining any deviations from the normal brought about by pathological changes.
- Thermography often facilitates detection of pathological changes before any other method ofinvestigation, and in some circumstances, is the only diagnostic aid available. Radiation hazard as with X-rays. In addition, thermography is a real-time system.

Infrared Radiation

The infrared ray is a kind of electromagnetic wave with a frequency higher than the radio frequencies and lower than visible light frequencies. There are several physical factors which affect the amount of infrared radiation from the human body. These factors are

- Emissivity
- Reflectivity
- Transmittance or absorption.

Emissivity

An object which absorbs all radiation incident upon it, at all wavelengths, is called a black body. A black body is only an idealized case and, therefore, all objects encountered in practice can be termed gray bodies. We thus define the term emissivity as representing the ratio of the radiant energy emitted per unit area by an object to the radiant energy emitted per unit area of the black body at the same temperature.

Reflection

Spectral reflectivity rl is defined as the ratio of reflected power to the incident power at a given wavelength.

Transmittance and Absorption of Infrared Radiation

When a semi-transparent body is placed between the surface of any radiation-emitting body and a detector, it is necessary to consider the change in emissivity related to its transmittance, reflectivity and emissivity

Infrared Detectors

Infrared detectors are used to convert infrared energy into electrical signals. Basically, there are two types of detectors:

- Thermal detectors
- Photo-detectors.

Thermal detectors include thermocouples and thermistor bolometers. They feature constant sensitivity over a long wavelength region.

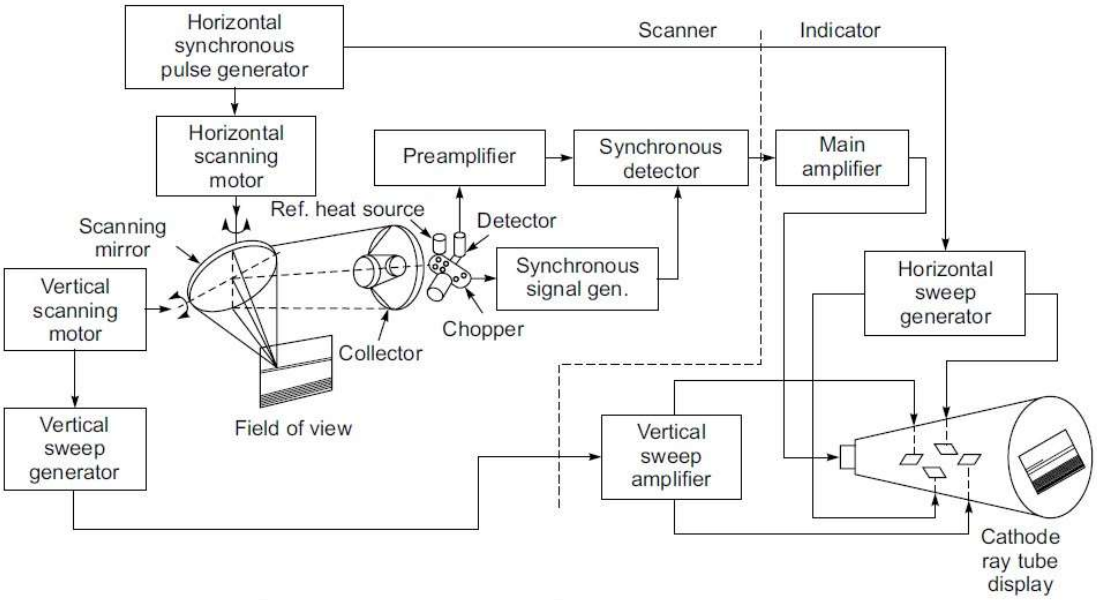
Thermographic Equipment's

Thermographic cameras incorporate scanning systems which enable the infrared radiation emitted from the surface of the skin within the field of view to be focused on to an infrared detector.

The equipment used in thermography basically consists of two units: a special infrared camera that scans the object, and a display unit for displaying the thermal picture on the screen.

The camera is generally mounted on a tripod that is fitted on wheels.

The camera unit contains an optical system which scans the field of view at a very high speed and focuses the infrared radiation on a detector that converts the radiation signal into an electrical signal. The signal from the camera is amplified and processed before being used to modulate the intensity of the beam in the picture tube. The beam sweeps across the tube face in a pattern corresponding to the scanning pattern of the camera. The picture on the screen can be adjusted for contrast (temperature range) and brightness (temperature level) by means of controls on the display unit.



➤ Fig. 24.6 *Block diagram of the scanning and displaying arrangements for infrared imaging*

Recording Techniques

- Quantitative Medical Thermography
- Digital Analysis of Thermograms

- Medical Thermography (digital infrared thermal imaging - DITI) is used as a method of research for early pre-clinical diagnosis and control during treatment of homeostatic imbalances. There are few devices, which operate in a passive method like infrared Thermography medicine; amongst these are the ECG and EEG. The intrinsic safety of this method makes infrared Thermography free from any limitations or contra- indications.
- Thermography is a non-invasive, non-contact tool that uses the heat from your body to aid in making diagnosis of a host of health care conditions. Thermography is completely safe and uses no radiation.
- Medical Thermography equipment usually has two parts, the IR camera and a standard PC or laptop computer. These systems have only a few controls and relatively easy to use.
- Monitors are high-resolution full colour, isotherm or grey scale, and usually include image manipulation, isothermal temperature mapping, and point-by-point temperature measurement with a cursor or statistical region of interest. The systems measure temperatures ranging from 10° C - 55° C to an accuracy of 0.1° C. Focus adjustment should cover small areas down to 75 x 75mm.
- These systems are PC based and therefore able to store tens of thousands of images (and these images may be retrieved for later analysis). The ability to statistically analyse the thermograms at a later date is very important in clinical work. Copies of images can easily be sent (via e-mail, floppy disk, etc.) to referring doctors or other healthcare professionals.
- The medical applications of DITI are extensive, particularly in the fields of Rheumatology, Neurology, Oncology, Physiotherapy and sports medicine. Thermal imaging systems are an economical easy-to-use tool for examining and monitoring patients quickly and accurately.
- Utilising high-speed computers and very accurate thermal imaging cameras, the heat from your body is processed and recorded in the computer into an image map which can then be analysed on screen, printed or sent via email.


- A doctor can then use the image map to determine if abnormal hot or cold areas are present. These hot and cold areas, can relate to a number of conditions for which the Food and Drug Administration, Bureau of Medical Devices has approved the thermography procedure. These include, the screening for breast cancer, extra-cranial vessel disease (head and neck vessels), neuro-Musculo-skeletal disorders and vascular disease of the lower extremities.
- The human body absorbs infrared radiation almost without reflection, and at the same time,emits part of its own thermal energy in the form of infrared radiation. The intensity of this radiantenergy corresponds to the temperature of the radiant surface. It is, therefore, possible to measurethe varying intensity of radiation at a certain distance from the body and thus determine thesurface temperature.
- In a normal healthy subject, the body temperature may vary considerably from time to time, butthe skin temperature pattern generally demonstrates characteristic features, and a remarkablyconsistent bilateral symmetry.

Applications of Thermography are in:

- Breast pathologies
- Extra-Cranial Vessel Disease
- Neuro-Musculo-Skeletal
- Vertebrae (nerve problems/arthritis)
- Lower Extremity Vessel Disease

Biotelemetry systems

Biotelemetry is the use of telemetry methods in order to remotely observe, document, and measure certain physiological functions in human beings or other living organisms. The field consists of several subfields, including medical and human research telemetry, animal telemetry, and implantable biotelemetry. Medical telemetry is of particular importance because it can be used to remotely track the vital signs of ambulatory patients.

Measurements which have been done in biotelemetry can be determined in two categories:

Bioelectrical variables, such as electrocardiogram (ECG), electromyogram (EMG) and electroencephalogram (EEG).

Physiological variables that require transducers, such as blood pressure, gastrointestinal pressure, blood flow and temperature. By using suitable transducers, telemetry can be employed for the measurement of a wide variety of physiological variables.

Elements of Telemetry