INTRODUCTION

About laser

- LASER is an acronym from "Light Amplification by Stimulated Emission of Radiation".
  It is a device which radiates coherent light by excitation of molecules in a gas, or electrons in a solid, to a high energy stage and their release of this energy in the form of light after amplification by to and fro oscillations.

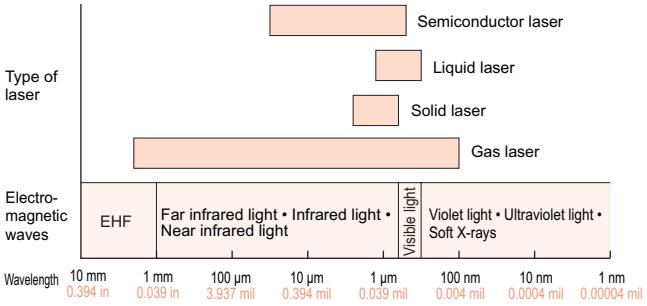
A laser beam has the following features:
① Monochromatic
② Low divergence
③ High energy density
④ Coherent in phase

Types of lasers

- Examples of materials which are used to emit laser beam are as follows:

Liquid .....Pigment
Gas .....He-Ne, Ar and CO_2
Solid .....YAG, Ruby and Glass
Semiconductor .....GaAs

<Laser beam wavelength>



SAFE USE OF LASERS

Safety standards for laser

- Even a thin laser beam has such a high energy density that it may be harmful to the human skin or eyes. For the purpose of preventing users from suffering injuries by laser products, IEC 60825-1 (Safety of laser products).
  IEC 60825-1 provides a classification system for laser products according to their degree of hazard, and safety requirements to be executed for each class of laser products. (The FDA regulations also have a similar classification.)

Overview of classification by IEC 60825-1

Classification	Description
Class 1	Lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.
Class 1M	Lasers emitting in the wavelength range from 302.5 nm to 4,000 nm which are safe under reasonably foreseeable conditions of operation, but may be hazardous if the user employs optics within the beam.
Class 2	Lasers that emit visible radiation in the wavelength range from 400 nm to 700 nm where eye protection is normally afforded by aversion responses, including the blink reflex. This reaction may be expected to provide adequate protection under reasonably foreseeable conditions of operation including the use of optical instruments for intrabeam viewing.
Class 2M	Lasers that emit visible radiation in the wavelength range from 400 nm to 700 nm where eye protection is normally afforded by aversion responses, including the blink reflex. However, viewing of the output may be more hazardous if the user employs optics within the beam.
Class 3R	Lasers that emit in the wavelength range from 302.5 nm to 10^6 nm where direct intrabeam viewing is potentially hazardous but the risk is lower than for Class 3B lasers, and fewer manufacturing requirements and control measures for the user apply than for Class 3B lasers.
Class 3B	Lasers that are normally hazardous when direct intrabeam exposure occurs (i.e. within the NOHD). Viewing diffuse reflections is normally safe.
Class 4	Lasers that are also capable of producing hazardous diffuse reflections. They may cause skin injuries and could also constitute a fire hazard.

Photoelectric Sensors
Pressure Sensors
Flow Sensors
Inductive Proximity Sensors
Displacement Sensors
Electrostatic Sensors
Static Removers
About Laser Beam
General Precautions

SAFE USE OF LASERS

FDA (Food and Drug Administration)

- The U.S. imposes regulations on the manufactures of laser products sold in the U.S. and obliges compliance with set standards through the Radiation Control for Health and Safety Act of 1968.
  The FDA has set regulations such as implementation standards related to laser products based on the law.
  The standards indicate a classification for the laser according to the degrees of risk of laser radiation and also engineering request items according to the class of laser. Laser products must be compliant with these regulations.

Performance standards for light-emitting products (Quoted from FDA part 1040)

Classification	Description
Class I	Not considered to be hazardous.
Class IIa	Not considered to be hazardous if viewed for any period of time less than or equal to 1×10^3 seconds but are considered to be a chronic viewing hazard for any period of time greater than 1×10^3 seconds.
Class II	Considered to be a chronic viewing hazard.
Class IIIa	Considered to be, depending upon the irradiance, either an acute intrabeam viewing hazard or chronic viewing hazard, and an acute viewing hazard if viewed directly with optical instruments.
Class IIIb	Considered to be an acute hazard to the skin and eyes from direct radiation.
Class IV	Considered to be an acute hazard to the skin and eyes from direct and scattered radiation.