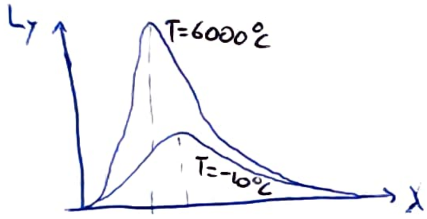
Exam 2017

Exercise 1

a) Done b) Done d) Done.

c) $T_1 = -10°C = 263\ K \longrightarrow \lambda_{max_1} = \frac{A}{T_1} \simeq \frac{10^{-3}}{263} \simeq 3{,}8\ \mu m$

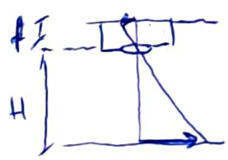
$T_2 = 6000°C = 6273K \longrightarrow \lambda_{max_2} = \frac{A}{T_2} \simeq \frac{10^{-3}}{6273} = 0{,}16\ \mu m$



Exercise 2

a) Done. b) Done. c) Done.

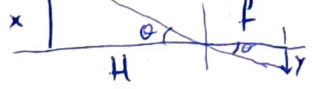
d) Obtain a formula for the scale of images collected by the camera



The scale of the image is the ratio of the size of the representation of an object on the map and the size of the object

size image: $y = f \tan\theta$ $\qquad s = \frac{y}{x} \Rightarrow \boxed{s = \frac{f}{H}}$

size object: $x = H \tan\theta$



e) Formula for the coverage on the ground of images collected by the camera

Using the scale of the image the coverage on the ground will be

$W_g = \frac{W}{s} \Rightarrow \boxed{W_g = w\frac{H}{f}}$ being w the width of the negative

f) Formula for spatial resolution on the ground → Done

Problem. Spatial resolution on the ground?

Data

$r = 100 \frac{lp}{mm} = 10^5 \frac{lp}{m}$ $f = 150\ mm = 0{,}15\ m$

$H = 5 km = 5 \cdot 10^3\ m$

$$\delta x_g = \frac{\delta x}{s} = \frac{1}{2r} \cdot \frac{H}{f} = \frac{5 \cdot 10^3}{2 \cdot 10^5 \cdot 0{,}15} \Rightarrow \boxed{\delta x_g = 0{,}166\ m}$$

Exercise 3

a). Done c). Done

b) Explain the meaning and importance of: following satellite orbits:

→ **Polar:** The polar orbit is the orbit where the satellite covers the north and the south polar regions.
It is use for instance to do an Earth-mapping. Weather satellites use this kind of orbits

→ **Geosynchronous:** It is an orbit with a period of sideral day 86164 seconds and it rotates in any axis around the Earth, not necessarily in the same rotation axis.
The sub-satellite path traces a lemniscate 8
It is useful for communications so the antennas don't have to move much

→ **Geostationary:** It is a geosynchronous orbit on the equator. This orbit is circular and obviously has a period of one sideral day.
It has a fixed position in the sky.
We can observe one point on the Earth permanently with this kind of satellites.

d) Period and velocity of IKONOS

$h = 680\ km \qquad r = R + h = 7051\ km$

• Period

$$T = 2\pi\sqrt{\frac{r^3}{GM}} = 2\pi\sqrt{\frac{(7051\cdot 10^3)^3}{6{,}67\cdot 10^{-11}\cdot 5{,}974\cdot 10^{24}}} = 5893{,}32\ sec \Rightarrow \boxed{T = 98{,}22\ min}$$

• Velocity

$$v = \sqrt{\frac{GM}{r}} = \sqrt{\frac{6{,}67\cdot 10^{-11}\cdot 5{,}974\cdot 10^{24}}{7051\cdot 10^3}} \Rightarrow \boxed{v = 7517{,}44\ m/s}$$