GEPL 4490/5490 Midterm Review

Format of the test: You will have the entire one hour and 40 minutes to finish the test. Most of you will not need it, but you have the time. There should not be any time pressure. There will be a section of short answers and a section of longer answers. Any equations or constants for the equations that you need will be provided at the end of the test. There will be several questions using equations. Make sure that you show your work in case you make a mistake. In addition, I will ask you to be able to see things in 3-D using the pocket stereoscope. You can borrow a stereoscope and photos if you would like to practice.

Anything that we talked about in class and anything that is in the book for the chapters we covered are fair game for the test.

Equations for the Midterm

Stefan-Boltzman Law – The energy emitted by an object is related to the fourth power of the temperature of that object.

$$E = \varepsilon\sigma T^4$$

where
E = total radiant exitance
σ= Stefan Boltzman constant = 5.67×10^{-8} W/m^2
T = Temperature (in K)
ε = emissivity

Wien's Displacement Law – Gives you the peak wavelength in μm of the black body curve emitted by an object.

$$\lambda_{\mu m} = \frac{2898 \mu m K}{T(K)}$$

where
λ_m =wavelength of maximum spectral radiation, μm
T = Temperature (K)

Be able to calculate energy emitted by the surface and the wavelength of peak emission.

Determining height of object using relief displacement (single vertical photo)

$$h = \frac{d}{r} H'$$

where
h = height of object
d = length of the displaced object (from bottom to top)
r = radial distance from nadir to the top of the displaced image
H' = aircraft height above the terrain.

Determining height of object using parallax (stereopair)

$$h_{obj} = H \frac{dP}{P + dP}$$

where
h_{obj} = height of object
H = aircraft flying height
ΔP = differential parallax, difference in displacement at bottom of object - displacement at top of object

$$\Delta P = (\Delta B - \Delta T)$$

P = absolute stereoscopic parallax at base of object often substitute average photo base length instead (pb1 + pb2)/2, which is the distance from the principal point of one photo to the conjugate principal point from the other photo.

Topics to study

- Know the remote sensing process.
    - What are the sources of energy for remote sensing? The sun, earth, and the sensor itself (active microwave sensor, i.e. radar).
    - Be able to relate the temperature of an object to the energy of the E/M radiation that it emits with the wavelength of the energy emitted.
    - What is a black body?
    - What is emissivity?
    - What is albedo
    - How does the atmosphere affect E/M radiation? Scattering (Mie and Rayleigh Non-selective), absorption (by ozone, oxygen…)?
    - What is an atmospheric window and how are they utilized in remote sensing? They are areas in the electromagnetic spectrum in which the atmosphere has a small influence on the transfer of energy from the surface to a sensor.
    - What are diffuse and direct radiation and how do they relate to clouds?
    - Surface interactions – albedo-reflection of the surface, bidirectional reflectance distribution function (BRDF). Why has BRDF research not made progress?
    - Specular reflection is mirror like. Lambertian reflection is uniform as from a rough surface.
    - **Spectral response – be able to draw the spectral response of vegetation, water, soil and clouds from .4 μm to 0.9 μm
- Describe the importance of Resolution, what it is what kinds are important to an remote sensor.
- Know the parts and pieces of an Aerial photo, and why Nadir and PP aren't the same and what is a CPP and why is it important.

- Photographs are continuous images and satellite images are made up of discrete picture elements called pixels whose values are digital numbers

EMF

- Hooke, Huygens, Newton, Young, Planck, Maxwell, Einstein to name a few. You should be comfortable with being able to note what part of the discovery the EMR These persons were involved.
- Wave or particle? What is EMR, How was the Photoelectric effect useful in understanding the wave or the particle theory.
- Know the interactions of the atmosphere, refraction, reflection, scattering, atmospheric windows and such.
- Additive and Subtractive colors what's the difference?
- Know the wavelengths what are the colors associated with wavelengths 400 to 2500 nm
- Know how to figure out the dominate wavelength.

Photography

- Know the types of film (black and white panchromatic, black and white infrared, color and color infrared). Infrared wavelengths can be used to detect deciduous trees. Know the basic wavelengths for the color of light.
- What are the additive primaries and the subtractive primaries?
- Some names should be known, Maxwell, Nadir, Niepce, Dagguerre. Lawerence,
- What is a camera obscura and why was it important?
- What was Corona? Why was it important?
- What are the three types of Aerial photographs what makes them so?
- How do filters works?
- How does Stereo imagery work?
- Know the name of the parts of an aerial photograph.

Photogrammetry

Review relief displacement and parallax - we can measure the heights of objects using their lean away from the principal point. Be able to do the calculations. Why does the scale change for a hilly area within a normal aerial photograph? What makes a Stereopair? If two successive photographs have at least 50% overlap, they can be used for stereographic viewing. What happens when we make the Airbase longer?
Know these terms: principal point, conjugate principal point, fiducial marks. Nadar.

**Know how to identify objects in remotely sensed images using the two lists. Know the topics that are in the list and the reason that the lists are used. Shape, size, pattern, shadow, tone/color, texture, association and site.

Be able to use the pocket stereoscopes to observe the landscape in 3-D