Midterm Exam Remote Sensing (AW3-3009)
17 May 2004

Question 1:

Spectral signatures or spectral reflectance curves of objects form the basis for object identification and image classification in earth observation. Spectral signatures can be illustrated using values of the brightness/reflectance in several spectral bands. Examples of spectral signatures are given below.

	UV	Blue	Green	Red	Near Infrared
Forest	28	29	36	27	56
Water	22	23	19	13	8
Corn	53	58	59	60	71
Pasture	40	39	42	32	62

a. Draw these spectral signatures on paper
b. Assume that these are pure signatures without atmospheric disturbance. Can all categories be reliably separated?
c. Which bands are most useful for distinguishing between these classes?
d. Assume now that the atmosphere is moist, dusty and hazy. What will happen to these spectral signatures? And in what wavelengths?

Question 2:

The sun is the most important source of electromagnetic radiance for earth observation. Two equations are required to compute how much energy the sun radiates and what spectral wavelength is the dominant wavelength of spectral emittance (consult also the attached equation sheet).

a. Describe the meaning of each of the 6 symbols in these two equations.
b. Suppose that the sun has an absolute temperature of 6000K. What is the spectral wavelength of maximum emittance of the sun? What is total radiant power of the sun? 7.35×10^7
c. Suppose that the earth has an absolute temperature of 300K. What is the spectral wavelength of maximum emittance of the earth? What is total radiant power of the earth?

visible

IR

4.59×10^2

Question 3:

Which 3 physical properties do we use to describe colours?

hue
saturation
brightness

Multiple choice questions Midterm Exam Remote Sensing
Indicate your choice with a, b, c or d.

Question 4:

An active remote sensing system is:
a. A sensor aboard a remote sensing platform that can be switched on or off from the ground base.
b. A satellite system that orbits the earth in a non geo-stationary orbit.
c. An earth observation system that emits electromagnetic radiance to do its observations.
d. A remote sensing system aboard a satellite platform that, before the data are transmitted to the earth, applies a geometric correction to all the acquired images.

Question 5:

Which of the 4 following statements are true?
1. The spectral wavelenghts 0.7 to 1.1 μm are not suitable for remote sensing observations, because ozon in the atmosphere absorbs radiance in this part of the electromagnetic spectrum.
2. The spectral region around 1.4 μm is not suitable for remote sensing observations, because water strongly absorbs radiance in this part of the spectrum.
3. The spectral region around 1.9 μm is not suitable for remote sensing observations, because water strongly absorbs radiance in this part of the spectrum.
4. All atmospheric windows are suitable for remote sensing observations.

a. Only statement 4 is true.
b. Statements 2, 3 and 4 are true.
c. All 4 statements are true.
d. Statement 2 and 3 are true.

Question 6:

Which of the three statements about radar remote sensing are right?

1. Radar remote sensing can observe the earth surface under clouded and overcast conditions.
2. Radar remote sensing observe the earth using wavelengths shorter than the visible wavelengths
3. De radar return pulse reflected by objects at the earth surface is mainly determined by surface roughness and dielectric properties.

a. Only statement 1 is true.
b. All statements are true.
c. Only statement 3 is true.
d. Statement 1 and 3 are true.

Appendix 1: Formule blad remote sensing tentamen

1. $Q = h * \nu$
2. $ht < \lambda/(8 * \sin\gamma)$
3. $Q = (h * c)/\lambda$
4. $R_r = c * \tau / (2 * \cos\theta_d)$
5. $\beta = \lambda / (A * L)$
6. $\lambda_m = A/T = 2898/T\ \mu m$
7. $p * V = (N * (m*v5))/3$
8. $E = h * f$
9. $M = \sigma * T^4 = 5.67 * 10^{-8} * T^4\ W/m5$
10. $M = \varepsilon * \sigma * T^4$
11. $\varepsilon = F_{\text{real material}} / F_{\text{black body}}$
12. $c = l * f$
13. $h = dH/r$
14. $P = 2 * (t + 14)$
15. $(1-\alpha) * R_s = R_l + G + H + LE$
16. $h < \lambda/(25 * \sin\gamma)$
17. $h > \lambda/(4.4 * \sin\gamma)$
18. $Etot = Er + Ea + Et$
19. $\alpha = 0.525*r(TM2) + 0.362*r(TM4) + 0.112*r(TM7)$
20. $ET(Ts) = -0.125*Ts - 0.085*\alpha + 43.73$
21. $DN = GL + B$