UNIVERSITI SAINS MALAYSIA

1st. Semester Examination
2000/2001 Academic Session

September / October 2000

**EAA 271/2 – REMOTE SENSING**

Time : [ 3 hours ]

**Instruction to candidates:-**

1. This paper consists of **FIVE (5)** questions. Answer **FOUR (4)** questions only.

2. Answers **MUST BE** written in Bahasa Malaysia.

1. (a)  In remote sensing, the energy sources used is the electromagnetic energy.  Briefly discuss with the aid of sketches and equations the following laws:

   (i)    basic wave theory
   (ii)   particle theory
   (iii)  blackbody theory
   (iv)   Wien displacement theory

(10 marks)

   (b)  Discuss in brief with the aid of sketches the electromagnetic spectrum.

( 5 marks)

   (c)  A spherical ball of diameter 15cm at 700K was hung in the air.  With the assumption that it resembles a black body, obtain

   (i)    the total blackbody emissive power
   (ii)   the total amount of radiation  emitted by the ball in 6 minutes.
   (iii)  the spectral emissive power at wavelength of  4.0μm.

   (Refer Table 1, Appendix "A")

   The Stefan-Boltzman constant is 5.67 x $10^{-8}$W/m$^3$k$^4$ and the Plank distribution Law is

$$E_{D\lambda} = \frac{C_1}{\lambda^5 (\exp(\frac{C_2}{\lambda T}) - 1)}$$

where $C_1 = 3.742 x 10^8 \dfrac{W \mu m^4}{m^2}$

$C_2 = 1.439 x 10^4 \mu m$

( 5 marks)

   (d)  The temperature of the filament of an incandescent bulb is 3000k.  Assuming the filament is a blackbody, determine the fraction of the radiant energy emitted by the filament falls which in the visible range (0.4μm – 0.76μm). Determine also the wavelength at which the emission of  radiation  from the filament peaks.

( 5 marks)

2.(a) i. Discuss clearly and in brief, the interactions of energy in the atmosphere for satellite and aircraft observations.

( 5 marks)

   ii. For atmosphere interactions with energy, discuss in brief the following terms:

   (a)    dispersion
   (b)    absorption

( 3 marks)

2. (b) i. Discuss in brief and clearly the energy interaction with the earth surfaces.

( 5 marks)

ii. For energy interaction with earth surfaces, discuss in brief the following terms,

(a)     specular reflector
(b)     diffuse reflector

( 3 marks)

(c)   Discuss with the aid of sketches the energy interaction with the following objects,

(i)      vegetation
(ii)     water
(iii)    soil
(iv)    geology

( 9 marks)

3. (a)   In the interpretation of images, especially via manual methods, discuss clearly with the help of examples, the eight (8) elements of image interpretation stated below:

(i)      shape
(ii)     size
(iii)    pattern
(iv)    hue
(v)     texture
(vi)    shadow
(vii)   location
(viii)  association

(10 marks)

(b).   In image interpretation, land-use and land-cover terms are often used. Discuss in detail, the difference between the two terms with the aid of examples.

( 5 marks)

(c)   For a pre-classification of a Landsat TM images shown in (Fig. 1, Appendix "B") state the classification method you would do using,

(i)      the spectral range, of a satellite image or band only.
(ii)     using a topographical map and satellite image.

(10 marks)

4. (a)  Discuss with the aid of sketches and examples the following terms:

   (i)    spectral resolution
   (ii)   spatial resolution
   (iii)  dynamic range (bits)

   ( 5 marks)


   (b)  Describe briefly the following scanner and satellite.

   (i)    Landsat MSS
   (ii)   Landsat TM
   (iii)  SPOT
   (iv)   SEASAT SAR
   (v)    SIR-B

   (10 marks)


   (c)  Discuss briefly with aid of examples, the following types of sensors.

   (i)    passive system
   (ii)   active system

   ( 5 marks)


   (d)  Discuss briefly an ideal sensing system for earth observation with respect to spectral and spatial resolution.

   ( 5 marks)


5. (a)  In pre-processing digital data, there are several methods that needs to be done is

   (i)    radiometric distortion correction
   (ii)   geometric distortion correction
   (iii)  image registration

       Describe in detail the methods stated above.

   ( 6 marks)


   (b)  Explain in detail the radiometric enhancement techniques and geometric enhancement techniques.

   ( 6 marks)

5. (c)  Explain clearly and briefly with the aid of diagrams and examples, the following5.

   (i)    supervised classifications method
   (ii)   unsupervised classification method

(  6 marks)

(d)  In classification process of a satellite, image in digital data, there due a few algorithm such as

   (i)    maximum likelihood
   (ii)   nearest distance
   (iii)  parallel piped

   Discuss in detail and brief the following  algorithm.

(  7 marks)

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