

Roll No: -----



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2017

Program/course: M.Tech/ASE+UAV
Subject: Remote Sensing & Surveillance
Code : MAEG831
No. of page/s: 03

Semester – III
Max. Marks : 100
Duration : 3 Hrs

INSTRUCTIONS:

1. No students will be allowed to leave the examination hall before 1hr.
2. Assume any missing data with suitable explanation.

SECTION-A [05x04=20]

1. What is the major difference between multiple spectral remote sensing and hyperspectral remote sensing? **04**
2. What is the major difference between thermal infrared remote sensing (3 -100 μm) and visible and near infrared (0.4 – 2.5 μm) based remote sensing. **04**
3. What is digital image processing? It includes? **04**
4. With neat sketch diagram, define the term “Swath” used in remote sensing. **04**
5. Define the following: Radiance, transmittance, absorptance, irradiance and emittance, spectral reflectance and albedo, which of these do a remote sensor directly measure? **04**

SECTION-B [10x04=40]

6. a) A radar operates at 10 GHz with the transmitter power of 10 KW. The radar signal is reflected from a target which is at a distance of 20 km. The radar cross section of the target is 10 m^2 . The gain of antenna is 20 dBi. Find the received signal power. **06**
b) Pulse radar transmits pulses whose pulse width is 1.2 μs . The reception rate of pulse is 0.8 kHz. Determine the minimum and maximum ranges of the radar. **02**
c) The noise figure of a radar receiver is 9 dB and if bandwidth is 2 MHz. find its minimum receivable signal. **02**
7. A UAS has taken the following images over the land of Vineyard, Luxembord as shown in Figure 1. Explain each of them with the definition of each band properties. What kind of remote sensing it is? How you could be able to judge the event. **10**

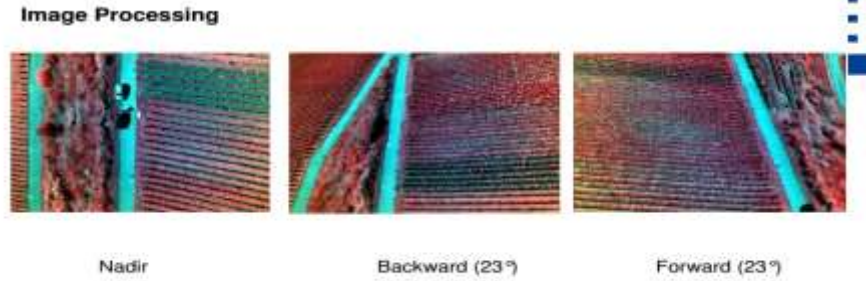


Figure 1

8. Explain the block diagram and the formation of synthetic aperture in case of the SAR image formation as shown in figure 2. Also define what do you understand by point target and how the peak can be obtained in PDF curve. **10**

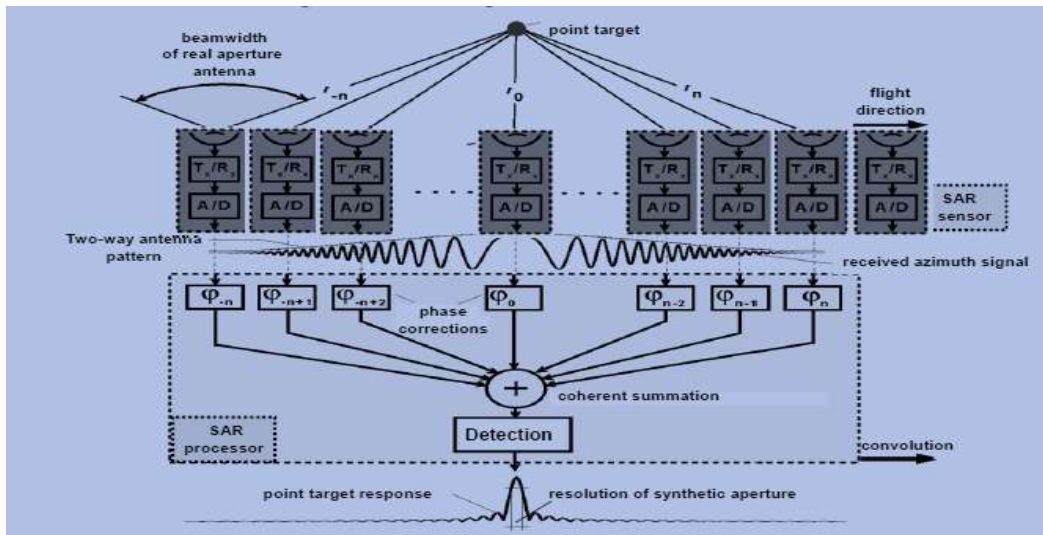


Figure 2

9. List out the ten difference between supervised and unsupervised image classifications specifically in remote sensing technologies. **10**

SECTION-C [20x02=40]

10. What is the difference between RADAR, SAR and SLAR? Define the properties of each sensor and systems. How aperture formation takes place? How SAR can be useful in image formation with reference to the signal processing. Describe the various SAR data formats. How raw data is differed from the geocoded processed images. Describe the formulations correlated in azimuth and range resolutions. Why the aperture antenna is differs from the real antenna of the SAR? **20**
11. A data has been acquired by means of the UAV remote sensing technique as shown in Figure 3. Explain how the suspended elements can be distracted from the

water body using the experimental and theoretical validation graphs as shown in Figure 3. 20

Estimating suspended sediments in water bodies

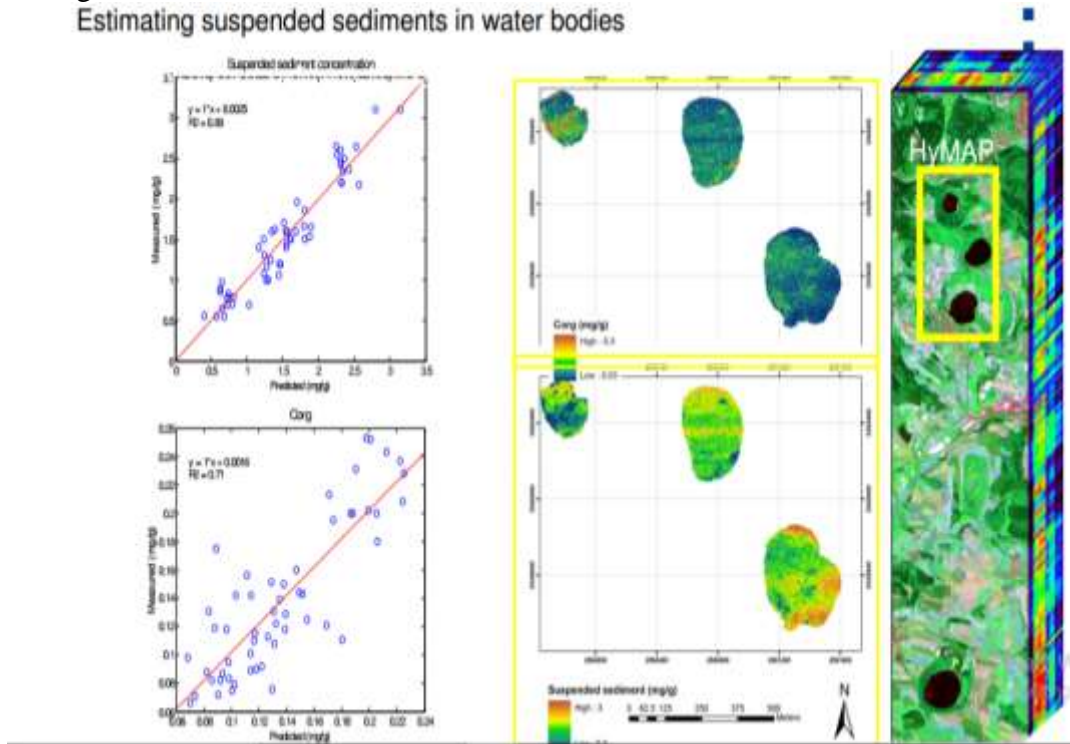


Figure 3

OR

11. Explain all the parameters of UAS classification and types as shown in Figure 4. 20

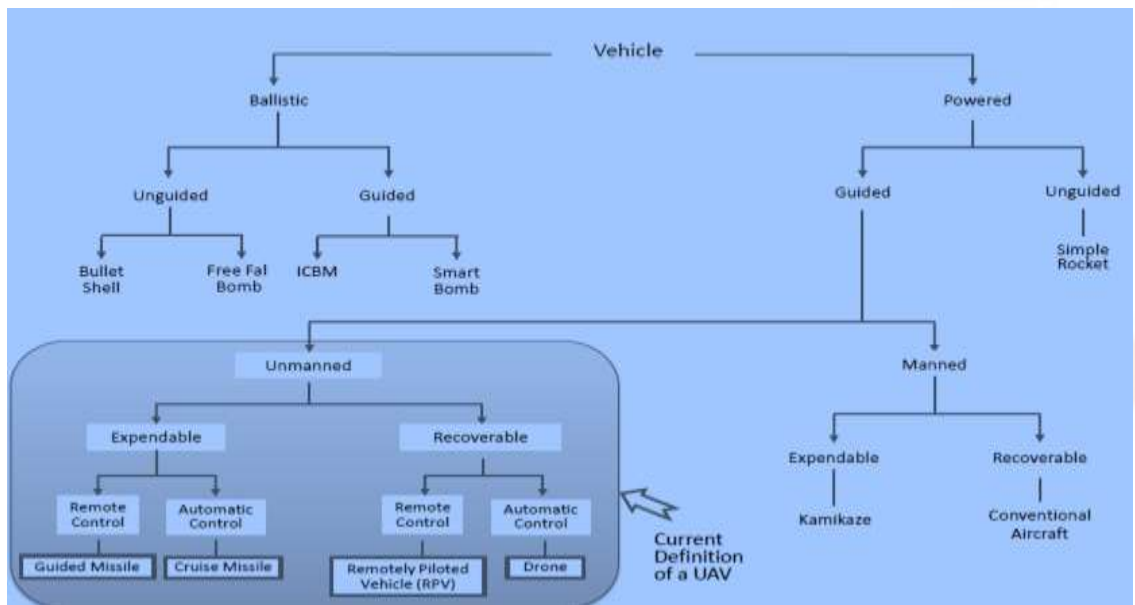


Figure 4

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INSTRUCTIONS:

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SECTION-A [05X04=20]

1. Define the basic principle of UAV remote sensing. In what ways the UAVs can be applied for remote sensing operations? **04**
2. Tabulate the various classes of UAV based on the payloads and sensing operations. Also classify the various UAVs in flow chart manner. **04**
3. What are the various launching pads used for the UAV remote sensing operations. Also signify the UAV recovery techniques. **04**
4. Draw and explain the data acquisition systems for UAV remote sensing operations. How the data could be transmitted to ground station and what the products come out at the user interface **04**
5. List out the various properties of LANDSAT satellite **04**

SECTION-B [10x04=40]

6. Explain the principle of RADAR. Derive radar range equation along with the various nomenclatures involved in it. **10**
7. a) A radar operates at 10 GHz with the transmitter power of 10 KW. The radar signal is reflected from a target which is at a distance of 20 km. The radar cross section of the target is 10 m^2 . The gain of antenna is 20 dBi. Find the received signal power. **06**
b) Pulse radar transmits pulses whose pulse width is $1.2 \mu\text{s}$. The reception rate of pulse is 0.8 kHz. Determine the minimum and maximum ranges of the radar. **02**
c) The noise figure of a radar receiver is 9 dB and if bandwidth is 2 MHz. find its minimum receivable signal. **02**

8. A UAS has taken the following images over the land of Vineyard, Luxembord as shown in Figure 1. Explain each of them with the definition of each band properties. What kind of remote sensing it is? How you could be able to judge the event. **10**

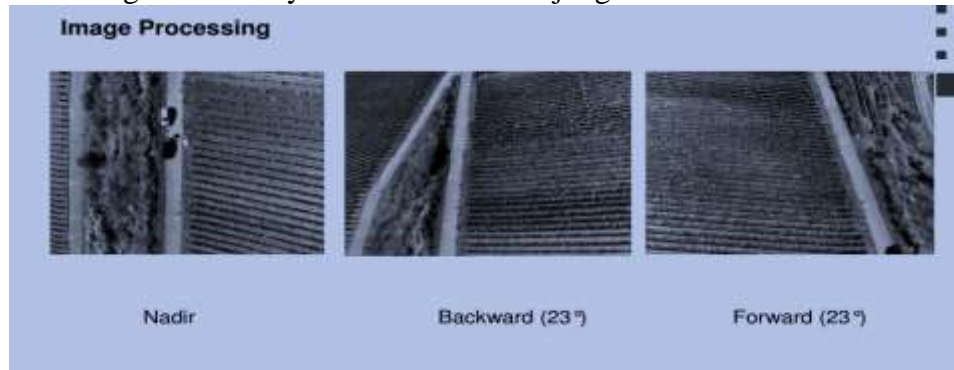


Figure 1

9. For a single band image, what type statistics parameters we usually look at. For multi-band image, to look at the interrelationship between images, we statistic parameters we use. In the following correlation figure, how you explain the relationship between those 4 bands: **10**

	Band 1	Band 2	Band 3	Band 4
Band 1	-	-	-	-
Band 2	0.35	-	-	-
Band 3	0.95	0.53	-	-
Band 4	0.94	0.16	0.87	-

SECTION-C [20x02=40]

10. An Open drone software is the platform which involves the various steps for the image processing for the data acquired by means of UAV as shown in figure 1. Explain the algorithm mentioned in the figure 1. Also define the various k values used in the figure for the processing step. What are P1, P2, P3 and P4 values? State with the certain example. **20**

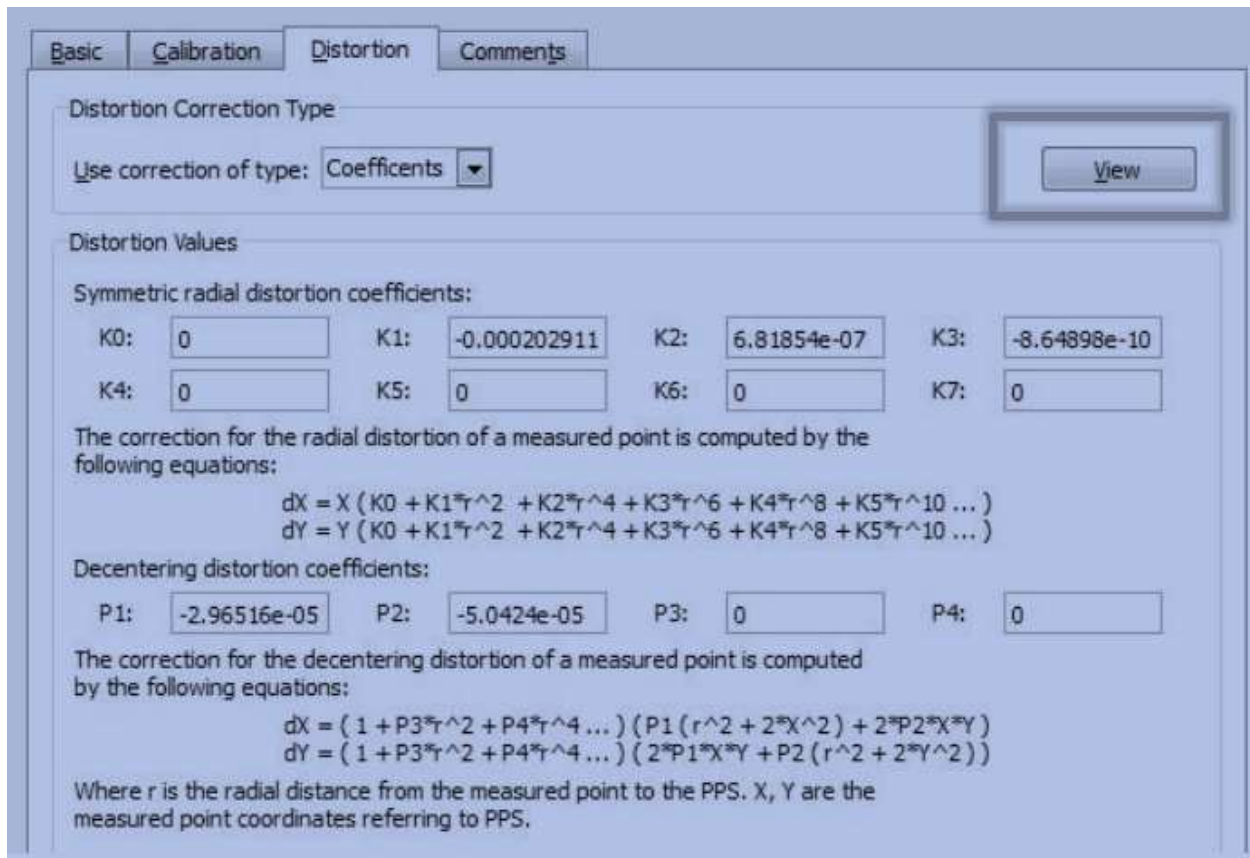


Figure 1

11. The figure below shows the Landsat-D mapping geometry. The background image is the earth surface. A landsat track from north to south is shown on the earth surface. Scan width, swath width, spatial resolution, the altitude of the satellite are all shown in the Figure 2. 20

Please answer the following questions:

- a. Based on the figure 1, what is the scanning configuration of the system? (1)
- b. What is the type of orbit of the satellite? (2)
- c. How many pixels each scan line has? (2)
- d. If the satellite moves at a speed of about 7 km/second, how many scans will be in each second? (2)
- e. how much the scan frequency (Hz) will be? (2)
- f. What is the dwell time? (2)
- g. Calculate the dwell time of this system (2)
- h. Do you think this system has good dwell time or bad dwell time? (2)
- i. We know this landsat has 7 bands, and radiometric resolution of the image is 8 bits, what is the data stream per second? (5)

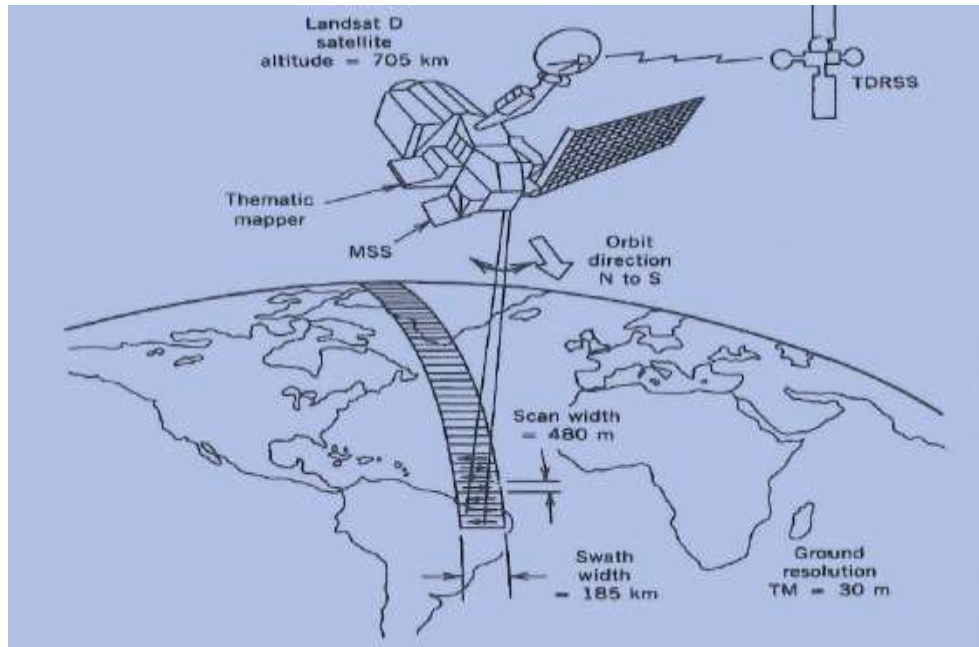


Figure 2

OR

11. What is the difference between RADAR, SAR and SLAR? Define the properties of each sensor and systems. How aperture formation takes place? How SAR can be useful in image formation with reference to the signal processing. Describe the various SAR data formats. How raw data is differed from the geocoded processed images. Describe the formulations correlated in azimuth and range resolutions. Why the aperture antenna is differs from the real antenna of the SAR?