## 1. Synthetic Aperture Radar (SAR) 27P

a. What is a Synthetic Aperture Radar (SAR)? Explain its principal idea and its advantages over a classical Real Aperture Radar / SLAR. **4P**

b. A SAR System always operates in a slanted geometry. Explain why a nadir-looking SAR System is not possible. **2P**

c. Explain the so-called 'layover' and "shadow" effects in SAR imaging (use a sketch if necessary). Which incidence angle ranges are preferable to minimise "layover" and "shadow" effects? **4P**

d. The SAR resolution in range and azimuth does not depend on the sensor's altitude. Which system parameters define range and azimuth resolution? **3P**

e. For a space-borne sensor with a 5m x 1m antenna (in azimuth / elevation) and 500km range distance: What is the maximum length of the synthetic aperture? What maximum azimuth resolution can be achieved? **4P**

f. Why a much smaller antenna is not necessarily good to increase resolution? **2P**

g. What is the PRF (Pulse Repetition Frequency)? Why there is a lower limit for the PRF? **3P**

h. What is the typical spatial resolution of a state-of-the-art space-borne X-band system? Name at least one of them! **2P**

i. What kinds of surfaces are expected to show high backscatter in a SAR image and which are expected to show low backscatter (2 examples each)? **3P**

## 2. SAR Polarimetry 10P

a. SAR Polarimetry measures 4 channels instead of 1. Explain what these 4 channels are, resp. what they contain, and how they are measured. **6P**

b. To measure polarimetric SAR data, the PRF needs to be increased. Explain why and describe the most important drawback of increasing the PRF. **4P**

## 3. SAR Interferometry 18P

a. SAR interferometry (InSAR) is a technique to measure ground topography and topographic changes. Briefly describe its principal idea. What kind of input data is needed to perform such an interferometric analysis? **3P**

b. What is the typical vertical precision of a digital surface model generated by the TanDEM-X satellite constellation? At which spatial resolution it is generated? **2P**

c. Differential SAR interferometry (DInSAR) measures ground deformation. Which precision can typically be achieved, and why it is much higher than the one of an InSAR derived elevation model? **4P**

d. Which component of the 3D deformation vector is measured by DInSAR? **2P**

e. What are the 2 most limiting limitations in DInSAR analysis? Describe their effects in the derived deformation maps. **4P**

f. The interferometric coherence is a measure of phase quality. What kinds of surfaces are expected to show high coherence and which are expected to show low coherence (2 examples each)? **3P**