Answers exam AE1203 Space Missions and Applications I – Nov 3, 2010

1.	True, a geostationary orbit is a special case of a geosynchronous orbit
2.	False, the geoid is not a mathematically perfect ellipsoid but it mimics the Earth with a minimal error margin
3.	False, the troposphere is the lowest region of the atmosphere. The characteristics belong to the ionosphere
4.	True, the reference system defines how the position is described. The reference frame uses that system
5.	True, it is located a few hundred kilometers off center
6.	b) GPS is a GNSS of the USA, COMPASS is Chinese and Galileo is the European equivalent. Navsys is a manufacturer of GPS receivers.
7.	d) Ionospheric delays can cause an error up to 5 m, due to its unpredictability. Wrong ephemeris data can cause deviations up to 2.5 m, whereas an wrong satellite clock causes the location to be off by 2 m. Multipath is the least problem, its associated error is only 1 m.
8.	c) $v = \sqrt{\frac{\mu}{a}} = \sqrt{\frac{3.986 \cdot 10^5}{6378+780}} = 7.46$ km/s Therefore an error of 1 second will cause the satellite to be located 7.5 km different than originally planned.
9.	d) Circular orbit, hence e = 0; a = 6378 + 705 = 7083 km The velocity can be calculated as with question 8; v = 7.50 km/s 1 orbit takes $\frac{2\pi \cdot (7083)}{7.50} = 5932.5$ seconds 1 sidereal day is 86164 seconds; 16 sidereal days is 1378624 seconds In the repeat period of 16 days the satellite makes $\frac{1378624}{5932.5} = 232$ orbits Hence the sampling density is $\frac{2\pi \cdot 6378}{232} = 172.4$ km
10.	b) $\frac{2\pi \cdot R_{moon,km}}{n_{max}} = \frac{2\pi \cdot 1.738 \cdot 10^3}{150} = 72.8$ km
11.	c) The gravity depends only on the latitude and is mirrored around the equator. Hence the value for 35 N is equal to the value for 35 S
12.	c)

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	$\lambda_{max} = \frac{2898}{T} = \frac{2898}{5900} = 0.4912\mu\text{m}$ $M_\lambda = \frac{3.74141 \cdot 10^8}{\lambda_{max}^5 (e^{(1.43879 \cdot 10^4)/(\lambda_{max} \cdot 5900))} - 1)} = 9.1978 \cdot 10^7$ W-m^{-2}-μm^{-1}
13.	a) UTC, GPS and TAI are all atomic time measured, UT1 is a solar day
14.	c) It's just that way
15.	b) Total added mass 140000000*0.123*1000=1.722E^{10} $\Delta a = \frac{\Delta m \cdot G}{r^2} = \frac{1722 \cdot 10^{10} \cdot 6.6726 \cdot 10^{-11}}{465000^2} = 5.314 \cdot 10^{-12}$m/s^2
16.	d) $-90 = 10 \cdot \log_{10} P > -9 = \log_{10} P > P = 10^{-9}$ Hence the signal is a factor P weaker than the signal that was sent. Hence we multiply with the original signal and we obtain 10^{-6} W
17.	?
18.	c) $\pi \cdot \frac{R_{moon}^2}{distance^2} = \pi \cdot \frac{1738^2}{384403^2} = 6.4 \cdot 10^{-5}$ sr
19.	a) The distance to cover is equal to 0.185 of an orbit (use the given angle with Pythagoras and you'll see). It covers 244/17=14.35 orbits a day hence 1 orbit takes 5894 seconds. 0.185 of an orbit takes 1090 seconds = 18 minutes. Add some extra for the rotation of the Earth in the opposite direction (I > 90 degrees!) and you'll get 22 minutes.
20.	?