S-92.3114 Spaceflight Instrumentation

Examination on 11. Dec. 2013, at 12.15-14.00

Four examination exercises give 24 points in maximum and it influences the final grade by 45 %. Final grade is not registered before the laboratory work is done.

Grading

1 = 11 p – 12 p, 2 = 13 p – 15 p, 3 = 16 p – 18 p, 4 = 19 p – 21 p, 5 = 22 p – 24 p.

Some constants:

Earth radius = 6371 km

Gravitational constant $\mu_e = 3.986 \times 10^{14}\ m^3 s^{-2}$

Stefan-Boltzman constant = $5.67 \times 10^{-8}\ Wm^{-2}K^{-4}$

Solar constant at 1 AU = $1350\ Wm^{-2}$

Some equations:

$$P = \eta I_s A \cos\theta$$

$$E_k = mv^2/2 \qquad E_p = -GMm/r$$

$$\tau = 2\pi\sqrt{\frac{a^3}{\mu}}$$

$$\varepsilon_s A_s \sigma T_s^4 = Q_{sun} + Q_{Et} + Q_{Er} + Q_i ,$$

$Q_{sun} = \alpha_s \pi R^2 I_{sun}$, $Q_{Et} = \varepsilon_s A_s F_{Et} \sigma T^4_E$

$$F_{Et} = \frac{1}{2}\left[1 - \frac{\sqrt{H^2 + 2H}}{1 + H}\right] \text{ where } H = \frac{h}{R_E}$$

$$\Delta v = V_e^* \ln\left(\frac{m_0}{m_b}\right)$$

$$F = \dot{m} V_e + A_e (p_e - p_a)$$

$$V_e' = V_e + \frac{A_e (p_e - p_a)}{\dot{m}} \qquad E_e = -GMm/2a$$

$$(1/2)v^2 - \mu/r = -\mu/(2a)$$