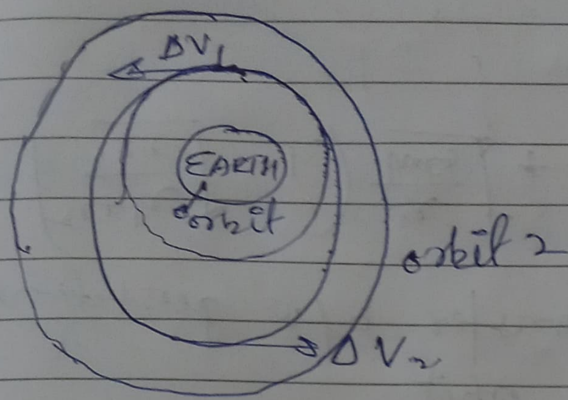
Date

Expt. No.

Page No.

Q.1



Transferring from orbit to intermediate orbit.

$$\frac{-GM_em}{2r_1} + \frac{1}{2}mv^2 = -\frac{GM_em}{r_1+r_2}$$

$$\Rightarrow 2\left(\frac{GM_e}{2r_1} - \frac{GM_e}{r_1+r_2}\right) = v^2$$

$$\sqrt{\frac{GM_e}{r_1}}\sqrt{\frac{r_1}{r_1+r_2}} = v_1$$

$$\Delta v_1 = \sqrt{\frac{GM_e}{r_1}}\left(\sqrt{\frac{r_2}{r_1+r_1}} - 1\right)$$

for transfering from intermediate orbit to at

$$\frac{-4M_em}{r_1+r_2} + \frac{1}{2}mv^2 = \frac{-GM_em}{2r_2}$$

$$\Rightarrow \Delta V_1 = \sqrt{\frac{GM_e}{r_2}}\left(\sqrt{\frac{2r_2}{r_1+r_2}} - 1\right)$$

Teacher's Signature

$$\Delta V_2 = \sqrt{\frac{GM}{r_1}}\left(1 - \sqrt{\frac{2r_1}{r_1+r_2}}\right)$$

$$\Delta V_{\cancel{radial}} = \Delta V_1 + \Delta V_2$$

$$= \sqrt{\frac{GM}{r_2}}\left(\sqrt{\frac{2r_1}{r_1+r_2}} - 1\right) + \sqrt{\frac{GM}{r_1}}\left(1 - \sqrt{\frac{2r_1}{r_1+r_2}}\right)$$

on putting value for ~~transfer~~ b/w geostationary orbit ~~of~~ and graveyard orbit

$r_1 = 35800 + R_e = 42200$ km

$r_2 = 6050 + R_e = 42450$ km

$(\Delta V_{avg})_Y = \Delta V_1 + \Delta V_2 = 9.07$ m/s.

Similarly on putting values for ~~transfer~~ b/w geostationary orbit ~~at~~ and low earth orbit.

$r_1 = 35800 + R_e = 42200$ km.

$r_2 = 400 + R_e = 4800$ km.

$(\Delta V_{total})_{LEO} = \Delta V_1 + \Delta V_2 = -3856$ m/s.

$(\Delta V_{total})_{GV} > (\Delta V_{total})_{LEO}$.

$\Rightarrow$ we would be transfer to geostationary orbit

(2) L_2 S L_3 E L_1

∵ for - on equipotential region
V = constant.

$\Rightarrow \frac{\partial V}{\partial r} = 0 \Rightarrow F = 0$

$\Rightarrow (F_G)_S + (F_G)_E = F_{\text{centrifugal force}} = F_2$.

for, L_1 region =

$$\frac{GM_s}{(x+r_1)^2} + \frac{GMe}{(x-r_2)^2} = \frac{G(M+M_2)}{R_{SE}^3} \times x$$

r_1 = Distance of sun from COM = $\frac{MeR}{Me+Ms}$

r_2 = Distance of earth from COM = $\frac{MsR}{Ms+Me}$.

$$GMs(x-r_2)^2R^3 + GMe(x+r_1)^2R^3 = G(M_1+M_2)x(x+r_1)(x-r_2)$$ (1)

~~for L_2 = 1.48 × 10^4 km,~~ $L_2 = \left(1 - \frac{M_E}{3M_0}\right)^{1/3} R$.

~~putting L_2 on eq^n~~

eq^n (2) = 0

L_2

$\Rightarrow M_s(x-x_2)^2 + M_e(x+x_1)R^3 = (M_s+M_e) \cdot x \cdot (x-x_1)(x+x_2)$ (2)

giving $L_1 = R\left(\left(1 - \left(\frac{M_e/M_s}{3}\right)\right)\right)^{1/3}$

putting L, M_e, M_s, R in L_1 and checking whether L_1 satisfies eq or not.

$L_2 = 1.515 \times 10^{11}$ km.

putting at in eq (1)

eq^n (1) $= 0$.

L_1 satisfies eq (1)

similarly for L_2,

eq^n (2)

$$\frac{GM_s}{(x-x_1)^2} + \frac{GM_e}{(x+x_2)^2} - \frac{G(M_s+M_e)}{R^3}x = 0.$$

$$M_s(x+x_1)^2R^3 + GM_e(x-x_2)^2 \cdot R^3 = (M_s+M_e)\,x(x-x_1)(x+x_2)$$

for $L_2 = 1.48 \times 10^{11}$ km $\cdot$ $L_2 = \left(1 + \left(\frac{M_e}{3M_s}\right)^{1/3}\right)R$.

with L_2 in eq^n (2)

eq^n(2) $= 0$.

$\Rightarrow$ L_2 satisfies eq^n (2)

for L_3

Date

Expt. No. Page No.

$$\frac{GM_s}{(x+r)^2} - \frac{GM_e}{(x-r_2)^2} = \frac{G(M_s+M_e)}{(r_1+r)^3}\,x. \quad \text{--- (3)}$$

$$L_3 = 1.5600187 \times 10^{11}.$$

$$L_3 = \cancel{-R\left(1+\frac{5}{12}\ldots\right)} = \left(-R\cdot\left[1+\frac{5}{12}\,\frac{M_2}{M_1}\right]1.0\right)$$

putting L_3 in eq^n (3)

$$eq^n\ 3 = 0$$

L_3 satisfies eq^n (3)

Q.3

Initially $V_{P/J}$ is in another direction But when it come to Jupiter ground It changes its speed as well as its direction

So we can apply law of conservation of Momentum b/w satellite & Jupiter Also Energy conservation as here only gravity is acting.

$$\vec{V}_{PG} = \vec{V}_{P/S} + \vec{V}_{J/S}$$

$$|\vec{V}_{JS} - \vec{V}_{PS}| = 16\,Rad/s$$