2.2 OPEN AND SHORT CIRCUIT TRANSMISSION LINES

OC AND SC

a) LOOP INDUCTANCE:

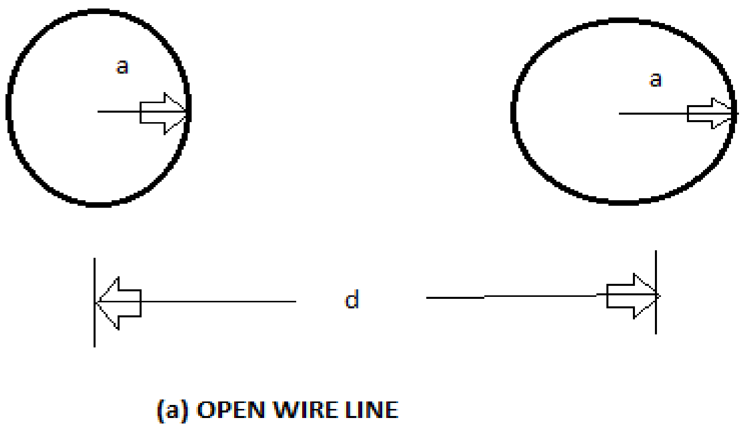

Fig : 2.2.1 Loop inductance of Open wire line

In Fig 2.2.1 shows that it consists of two spaced parallel wire supported by insulators; at proper distance to give a desired value of inductance.

a = Radius of the each line

d = Spacing between two parallel lines

Inductance of an open wire line is given by,

$L = \frac{\mu_0}{2\pi} \ln \frac{d}{a}$

$L = \frac{4\pi X 10^{-7}}{2\pi} \ln \frac{d}{a}$ H/m

The self-inductance of an open wire lines together is given by,

$L = 0.1\ \mu_r + 0.921\ log_{10} \frac{d}{a}$ H/m

Where,

a = radius of the conductor

d = distance b/w the conductor

μ_r = Relative permeability of the conductor

b) LOOP INDUCTANCE IN COAXIAL CABLE:

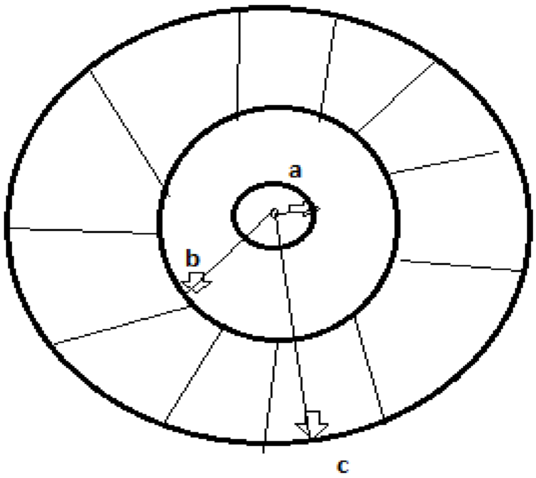

Fig : 2.2.2 Loop inductance of Coaxial cable

In Fig 2.2.2,

$$L = \frac{\mu_d}{2\pi} log_e \left(\frac{d}{a}\right) + \frac{\mu_c}{2\pi} \left[\frac{4c}{c^2 - b^2} \log \left(\frac{c}{b}\right) - \frac{2c^2}{c^2 - b^2}\right]$$

a = radius of the inner conductor

b = inner radius of the outer conductor

c = outer radius of the outer conductor

μ_c = permeability of the conductor

μ_d = permeability of the dielectric.

SHUNT CAPACITANCE:

a) FOR OPEN WIRE LINE:

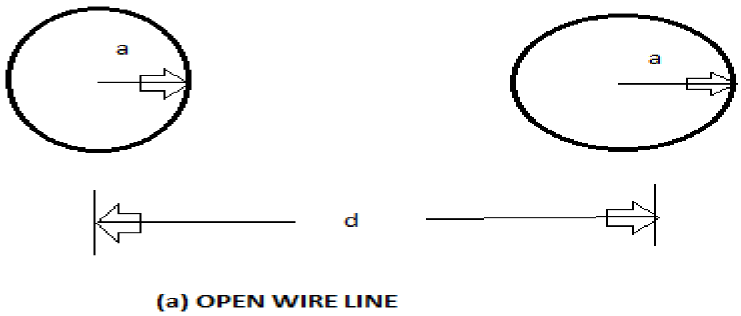

Fig : 2.2.3 Shunt capacitance of Open wire line

In Fig 2.2.3 shows that it consists of two spaced parallel wire supported by insulators; at proper distance to give a desired value of capacitance.

C = $\frac{\pi \, \varepsilon_d}{log_e\left(\frac{d}{a}\right)}$ F/m

ε_d = Permeability of the dielectric

= radius of the conductor

d = distance b/w the conductor

b) FOR COAXIAL CABLE:

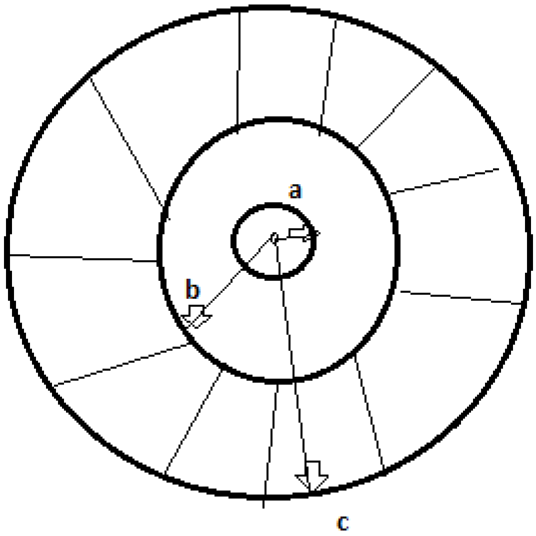

Fig : 2.2.4 Shunt capacitance of Coaxial cable

In Fig 2.2.4,

C = $\frac{2\pi \, \varepsilon_d}{log_e\left(\frac{d}{a}\right)}$ F/m

a = radius of the inner conductor

b = inner radius of the outer conductor

LOOP RESISTSNCE:

a) FOR OPEN WIRE LINE:

In Fig 2.2.5 shows that it consists of two spaced parallel wire supported by insulators; at proper distance to give a desired value of resistance.

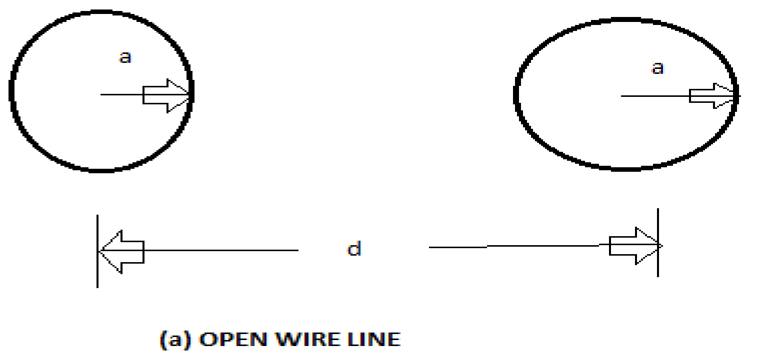

Fig : 2.2.5 Loop resistance of Open wire line

$R_{dc} = \frac{2}{\pi\sigma a^2}$

$R_{ac} = \frac{R_{dc}}{2}$ a $\sqrt{\pi\sigma\mu_c f}$

σ = conductivity

μ_c = permeability of a conductor

f = frequency

a = radius of the conductor

b) <u>FOR COAXIAL LINE:</u>

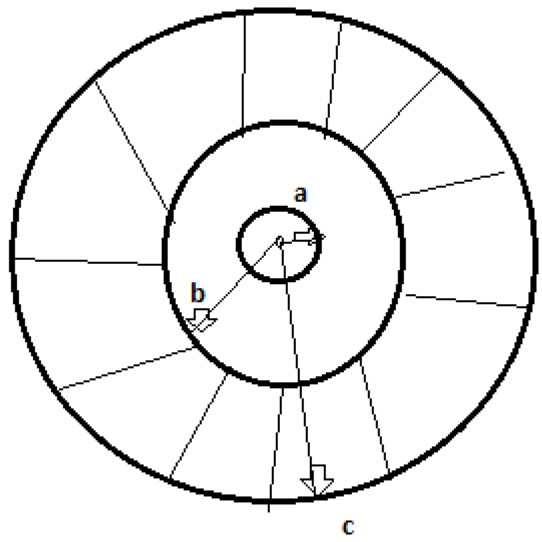

Fig : 2.2.6 Loop resistance of Coaxial cable

In Fig 2.2.6,

$$R_{dc} = \frac{1}{\pi\sigma}\left[\frac{1}{a^2} + \frac{1}{c^2 - b^2}\right]$$

$$R_{ac} = \sqrt{\frac{\mu_c f}{4\pi\sigma}}\left(\frac{1}{a} + \frac{1}{b}\right)$$

All the parameters of R, L, G, C will change with respect to weather condition.