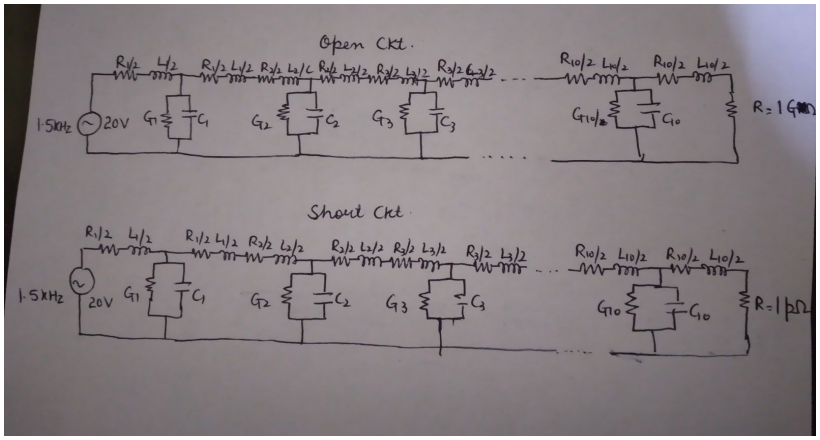
Engineering Electromagnetics Lab
Experiment 2

OBJECTIVE - (a) To study voltage distribution along a lumped constant delay line (Transmission line) using PSPICE AD software when the line is (i) Open circuited (ii) Short circuited, and (iii) terminated in Z0.
(b) Determine the line parameters α, β, γ, λ1 from the study in (a).
SOFTWARES USED - PSPICE AD,MATLAB
Circuit Diagram:



Formula used:
$V_n = V_s * \exp(-\alpha n)$
w = 2*pi*1500 rad / sec
α = sqrt((sqrt(R*R+w*w*L*L) * sqrt(G*G+w*w*C*C) + R*G*G - w*w*L*C) /2)
β = sqrt((sqrt(R*R+w*w*L*L)*sqrt(G*G+w*w*C*C)-(R*G*G-w*w*L*C))/2)
λ = 2*pi / β

PSPICE Code:

```
* Using subcircuit command:
V1 1 0 sin(0 20 1.5k)
R1 1 2 1e-3
X1 2 0 3 tsection
X2 3 0 4 tsection
X3 4 0 5 tsection
X4 5 0 6 tsection
X5 6 0 7 tsection
X6 7 0 8 tsection
X7 8 0 9 tsection
X8 9 0 10 tsection
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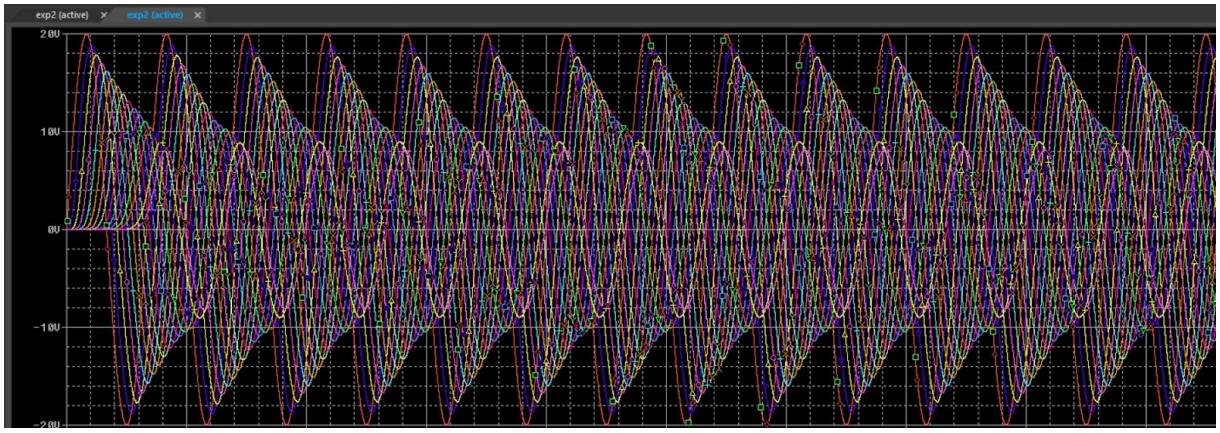
```
X9 10 0 11 tsection
X10 11 0 12 tsection
X11 12 0 13 tsection
X12 13 0 14 tsection
R2 14 0 89.3
.subckt tsection 1 6 5
R1 1 2 5
L1 2 3 2m
C1 3 6 0.47u
R2 3 6 1e4
R3 3 4 5
L2 4 5 2m
.ends tsection
.tran 0 10ms [0 100ns]
.probe
```

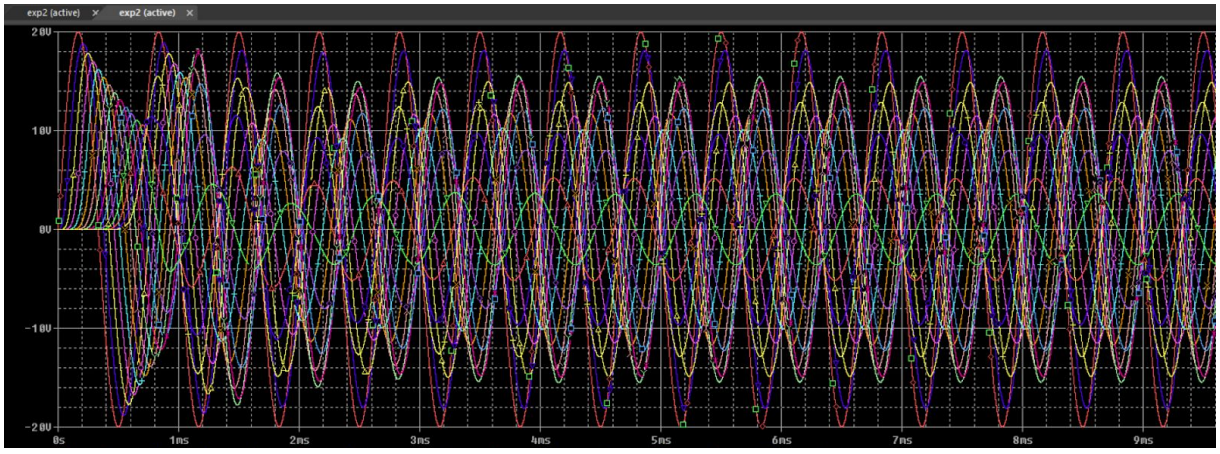
OBSERVATIONS AND SIMULATION DATA

For alpha

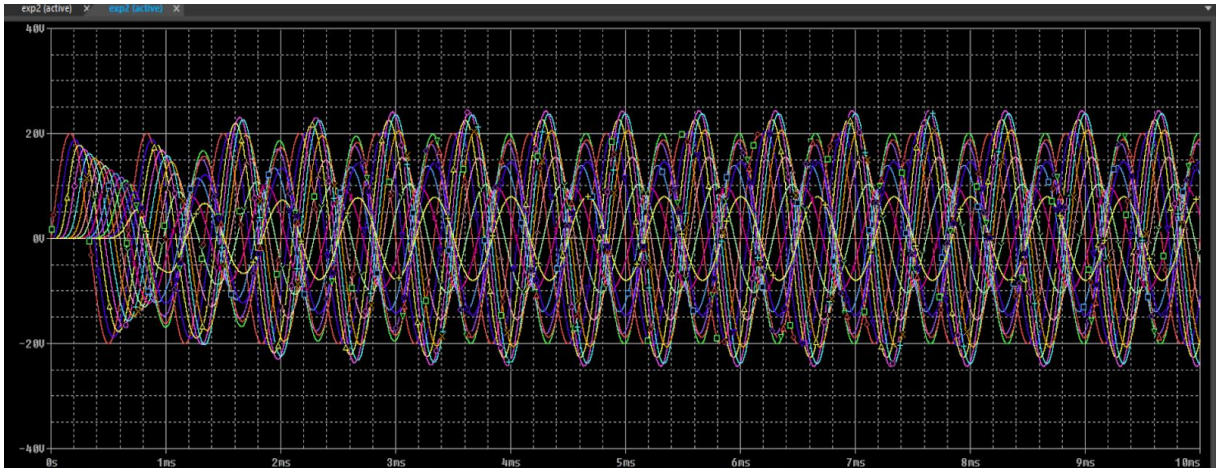
For Beta
Characteristic Impedance



Open ckt



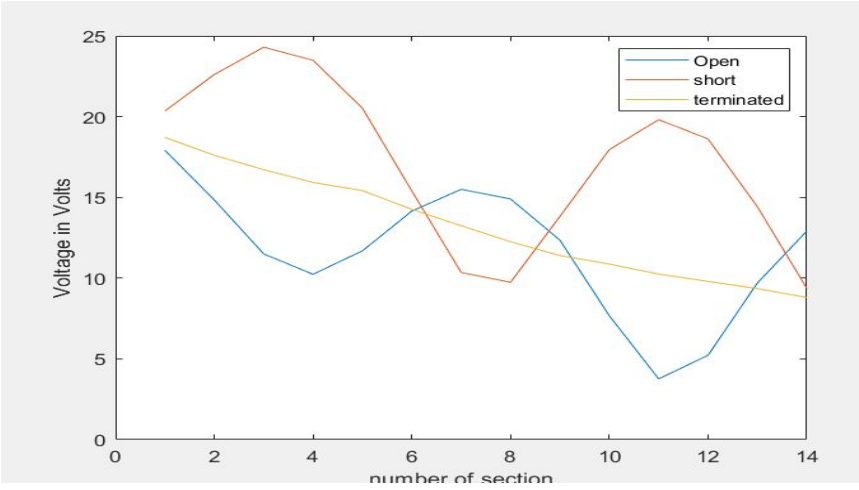
Short ckt



Observation Table

S. No.	Section	Open Ckt Voltage(V)	Short Ckt Voltage(v)	Terminated Ckt Voltage(V)
1	T1	17.913	20.355	18.718
2	T2	14.844	22.609	17.603
3	T3	11.513	24.302	16.719
4	T4	10.237	23.491	15.921
5	T5	11.695	20.522	15.421
6	T6	14.151	15.406	14.257
7	T7	15.527	10.356	13.244
8	T8	14.932	9.739	12.253
9	T9	12.355	13.826	11.398
10	T10	7.671	17.953	10.870
11	T11	3.769	19.813	10.256
12	T12	5.224	18.621	9.823
13	T13	9.701	14.418	9.356
14	T14	13.646	11.237	8.966

Graph



From graph : λ/2 = 7.5 or λ = 15

CALCULATIONS

Values used

Z0=89.3 Ohms (1st experiment)

R=10ohm

G=10e-4ohm

L=4 mh

C=0.47uF

V_s=20V(peak to peak)

V_n=15.470V(peak to peak)

n=5

$V_n=V_s$* exp(-αn)

α=0.048 neper/section length

S. No.	Quantity	Theoretical Value	Experimental value	Error
1	α	0.0539	0.048	10.9%
2	β	0.4188	0.4119	3.7%
3	γ	0.0539 + j0.4122	0.048+j0.4119	1.2%
4	λ	15.423	15	4.5%

Submitted by
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