EX NO 2. CALCULATION OF LOOP INDUCTANCE OF SINGLE-PHASE OVERHEAD TRANSMISSION LINE USING SCILAB

a) A single-phase transmission line consists of two parallel conductors separated by a distance of 2 meters, with each conductor having a diameter of 1.2 cm. Calculate the loop inductance per kilometre of the line.
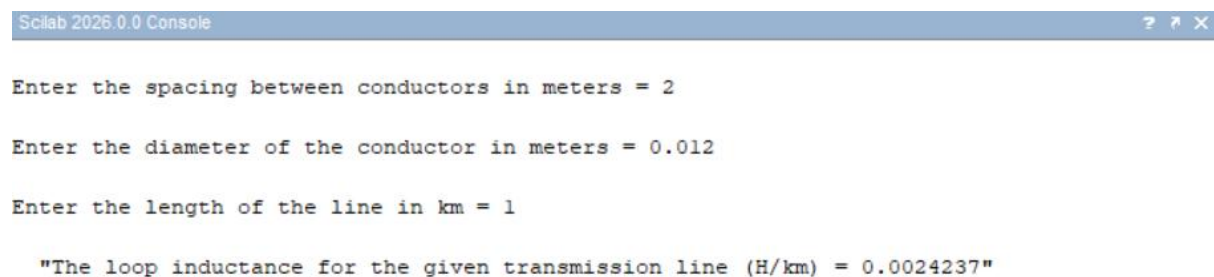
SOURCE CODE:

```
clc;

clear;


d = input('Enter the spacing between conductors in meters: ');

dia = input('Enter the diameter of the conductor in meters: ');

r = dia / 2;

l = input('Enter the length of the line in km: ');


// Loop inductance per km
li = 1e-7 * (1 + 4 * log(d / r)) * 1000;

disp(li, 'The loop inductance for the given transmission line (H/km) =');
```

OUTPUT :

```
Scilab 2026.0.0 Console                                          ?  ↗ X

Enter the spacing between conductors in meters = 2

Enter the diameter of the conductor in meters = 0.012

Enter the length of the line in km = 1

  "The loop inductance for the given transmission line (H/km) = 0.0024237"
```

b) For a single-phase, two-wire transmission line of length 10 km, the conductors are separated by 1.5 meters, and each conductor has a diameter of 1 cm. Given that the conductors are made of copper, determine the total inductance of the circuit.

SOURCE CODE:

clc;

clear;

l = input("Enter the length of the line in km = ");

d = input("Enter the distance between conductors in meters = ");

dia = input("Enter the diameter of each conductor in meters = ");
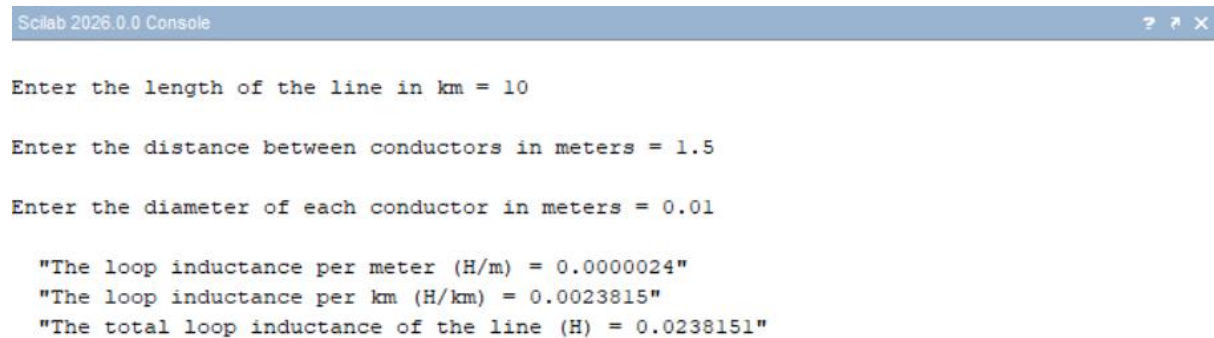
r = dia / 2;

// Loop inductance per meter

li = 4e-7 * log(d / (0.7788 * r));

disp("The loop inductance per meter (H/m) = " + string(li));

// Loop inductance per km

likm = li * 1000;

disp("The loop inductance per km (H/km) = " + string(likm));

// Total loop inductance of the line

l_total = likm * l;

disp("The total loop inductance of the line (H) = " + string(l_total));

OUTPUT :

```
Scilab 2026.0.0 Console                                              ? ↗ ✕

Enter the length of the line in km = 10

Enter the distance between conductors in meters = 1.5

Enter the diameter of each conductor in meters = 0.01

  "The loop inductance per meter (H/m) = 0.0000024"
  "The loop inductance per km (H/km) = 0.0023815"
  "The total loop inductance of the line (H) = 0.0238151"
```

EX NO 3. CALCULATION OF INDUCTANCE OF SYMMETRICAL THREE PHASE LINE USING SCILAB

a) Calculate the inductance per kilometer of a 3-phase transmission line with conductors of 1.24 cm diameter, arranged at the corners of an equilateral triangle with each side measuring 2 meters.
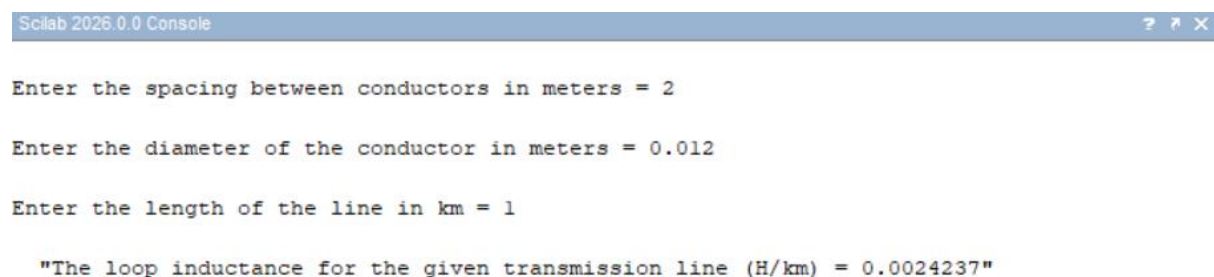
SOURCE CODE:

```
clc;

clear;


d = input("Enter the spacing between conductors in centimeter = ");

r = input("Enter the radius of the conductor in centimeter = ");


// Inductance per meter

Ip = 1e-7 * (0.5 + 2 * log(d / r));

disp("Inductance of 3-phase symmetrical transmission line per meter (H/m) = " + string(Ip));


// Inductance per kilometer

Ip_km = Ip * 1000;

disp("Inductance per kilometer (H/km) = " + string(Ip_km));
```

OUTPUT :

```
Scilab 2026.0.0 Console                                          ? ⊼ X

Enter the spacing between conductors in meters = 2

Enter the diameter of the conductor in meters = 0.012

Enter the length of the line in km = 1

  "The loop inductance for the given transmission line (H/km) = 0.0024237"
```

b) Find the inductance per km per phase of a 3-phase overhead transmission line using 2 cm diameter conductor when these are placed at the corners of an equilateral triangle of side 4 metres.
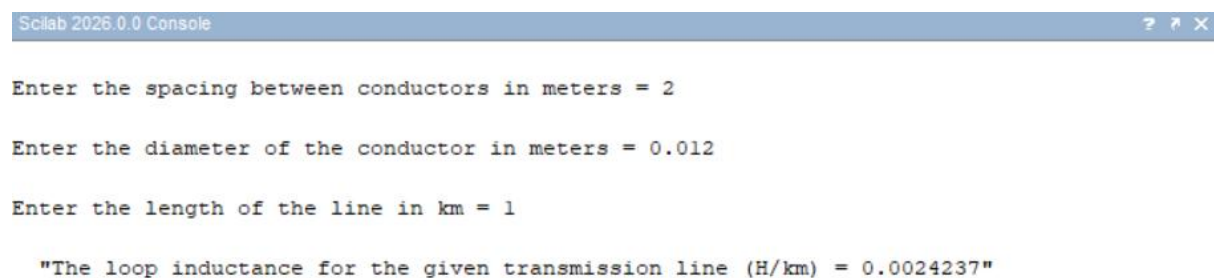
SOURCE CODE:

```
clc;
clear;


d = input("Enter the spacing between conductors in centimeter = ");
r = input("Enter the radius of the conductor in centimeter = ");


// Inductance per meter
Ip = 1e-7 * (0.5 + 2 * log(d / r));
disp("Inductance of 3-phase symmetrical transmission line per meter (H/m) = " + string(Ip));


// Inductance per kilometer
Ip_km = Ip * 1000;
disp("Inductance per kilometer (H/km) = " + string(Ip_km));
```
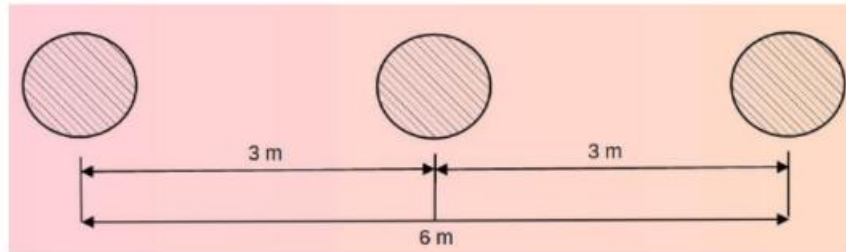
OUTPUT :

```
Scilab 2026.0.0 Console                                                    ?  ⁊ X

Enter the spacing between conductors in meters = 2

Enter the diameter of the conductor in meters = 0.012

Enter the length of the line in km = 1

   "The loop inductance for the given transmission line (H/km) = 0.0024237"
```

EX NO 4. CALCULATION OF INDUCTANCE OF AN UNSYMMETRICAL THREE PHASE LINE USING SCILAB

a) A 3-phase 50 km long single circuit 66 kV transposed overhead line has horizontal spacing with 3 m between adjacent conductors and 6 m between outer conductors. The conductor diameter is 2 cm. Find the Inductance per phase.

SOURCE CODE:

```
clc;

clear;


// --------------------------------------------------

// Given data

// --------------------------------------------------

D = 2;              // spacing in meters (equilateral triangle)

dia = 1.24e-2;         // diameter in meters

r = dia / 2;         // radius in meters


// --------------------------------------------------

// Equivalent spacing

// --------------------------------------------------

Deq = D;


// --------------------------------------------------

// Inductance per meter

// --------------------------------------------------

Iphm = 1e-7 * (0.5 + 2 * log(Deq / r));
```

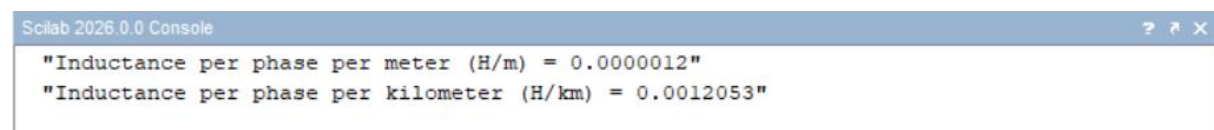disp("Inductance per phase per meter (H/m) = " + string(Iphm));

// ---

// *Inductance per kilometer*

// ---

Iph_km = Iphm * 1000;

disp("Inductance per phase per kilometer (H/km) = " + string(Iph_km));

OUTPUT :

```
Scilab 2026.0.0 Console                                                    ?  ⊼  X
  "Inductance per phase per meter (H/m) = 0.0000012"
  "Inductance per phase per kilometer (H/km) = 0.0012053"
```

b) Determine the inductance of each conductor in a 3-phase, 3-wire system where the conductors are arranged in a horizontal plane. The spacing between the conductors is D31 = 4 m and D12 = D23 = 2 m. The conductors are transposed and have a diameter of 2.5 cm.

SOURCE CODE:

```
clc;

clear;


d1 = input("Enter the spacing between conductors D12 in meters = ");

d2 = input("Enter the spacing between conductors D23 in meters = ");

d3 = input("Enter the spacing between conductors D31 in meters = ");

r  = input("Enter the radius of the conductor in meters = ");


// Equivalent spacing
Deq = (d1 * d2 * d3)^(1/3);


// Inductance per meter
Iphm = 1e-7 * (0.5 + 2 * log(Deq / r));
disp("Inductance of 3-phase unsymmetrical transmission line per meter (H/m) = " + string(Iphm));


// Inductance per kilometer
Iph_km = Iphm * 1000;
disp("Inductance per kilometer (H/km) = " + string(Iph_km));
```

OUTPUT :

```
Enter the spacing between conductors D12 in meters = 2

Enter the spacing between conductors D23 in meters = 2

Enter the spacing between conductors D31 in meters = 4

Enter the radius of the conductor in meters = 0.0125

   "Inductance of 3-phase unsymmetrical transmission line per meter (H/m) = 0.0000011"
   "Inductance per kilometer (H/km) = 0.0011112"
```

EX NO 5. CALCULATION OF CAPACITANCE OF SINGLE PHASE LINE USING SCILAB

a) A single-phase transmission line has two parallel conductors 3 metres apart, radius of each conductor being 1 cm. Calculate the capacitance of the line per km. Given that $\varepsilon_0 = 8{\cdot}854 \times 10^{-12}$ F/m

SOURCE CODE:

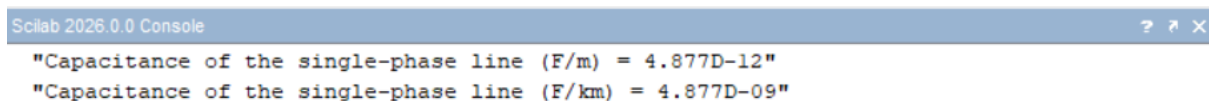```
clc;

clear;

// Given values

d = 300;   // spacing in cm (3 m = 300 cm)

r = 1;   // radius in cm

epsilon0 = 8.854e-12;

// Capacitance per meter

Cl = %pi * epsilon0 / log(d / r);

disp("Capacitance of the single-phase line (F/m) = " + string(Cl));

// Capacitance per kilometer

Cl_km = Cl * 1000;

disp("Capacitance of the single-phase line (F/km) = " + string(Cl_km));
```

**OUTPUT :**

```
Scilab 2026.0.0 Console                                              ?  ↗ ✕
 "Capacitance of the single-phase line (F/m) = 4.877D-12"
 "Capacitance of the single-phase line (F/km) = 4.877D-09"
```

b) Find out the capacitance of a single phase line of 30 km long consisting of two parallel wires each 15 mm diameter and 1.5 m apart.
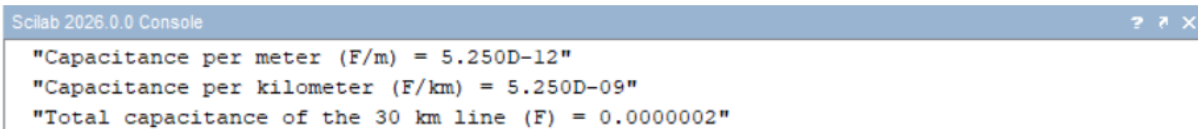
SOURCE CODE:

clc;

clear;

// Capacitance per meter

C_per_m = %pi * epsilon0 / log(d / r);

disp("Capacitance per meter (F/m) = " + string(C_per_m));

// Capacitance per kilometer

C_per_km = C_per_m * 1000;

disp("Capacitance per kilometer (F/km) = " + string(C_per_km));

// Total capacitance for 30 km line

C_total = C_per_km * length_km;

disp("Total capacitance of the 30 km line (F) = " + string(C_total));

OUTPUT :

```
Scilab 2026.0.0 Console                                              ? ↗ ✕
 "Capacitance per meter (F/m) = 5.250D-12"
 "Capacitance per kilometer (F/km) = 5.250D-09"
 "Total capacitance of the 30 km line (F) = 0.0000002"
```

EX NO 6. CALCULATION OF CAPACITANCE OF THREE PHASE SYMMETRICAL LINE USING SCILAB

a) A 3-phase overhead transmission line has its conductors arranged at the corners of an equilateral triangle of 2 m side. Calculate the capacitance of each line conductor per km. Given that diameter of each conductor is 1·25 cm.

SOURCE CODE:

clc;

clear;

// Given values

d = 200;　　　　　*// spacing in cm (2 m = 200 cm)*

r = 1.25 / 2;　　　*// radius in cm*

epsilon0 = 8.854e-12;　*// F/m*

// Capacitance per conductor per meter

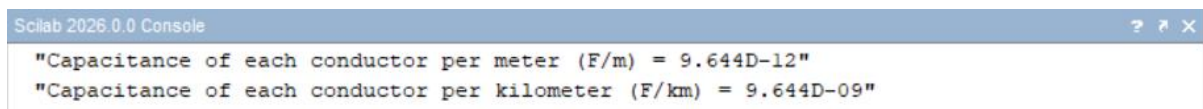Cl = %pi * 2 * epsilon0 / log(d / r);

disp("Capacitance of each conductor per meter (F/m) = " + string(Cl));

// Capacitance per kilometer

Cl_km = Cl * 1000;

disp("Capacitance of each conductor per kilometer (F/km) = " + string(Cl_km));

OUTPUT :

```
Scilab 2026.0.0 Console                                           ? ⌐ X
 "Capacitance of each conductor per meter (F/m) = 9.644D-12"
 "Capacitance of each conductor per kilometer (F/km) = 9.644D-09"
```

b) Calculate the capacitance of a 100 km long 3-phase, 50 Hz overhead transmission line consisting of 3 conductors each of diameter 2 cm and spaced 2.5 m at the corners of an equilateral triangle.

SOURCE CODE:

```
clc;

clear;

// Given values

length_km = 100;         // km

D = 2.5;                 // spacing in meters

dia = 2e-2;              // diameter in meters

r = dia / 2;             // radius in meters

epsilon0 = 8.854e-12;    // F/m


// Capacitance per conductor per meter

C_per_m = 2 * %pi * epsilon0 / log(D / r);

disp("Capacitance per conductor per meter (F/m) = " + string(C_per_m));


// Capacitance per conductor per kilometer

C_per_km = C_per_m * 1000;

disp("Capacitance per conductor per kilometer (F/km) = " + string(C_per_km));


// Total capacitance for 100 km

C_total = C_per_km * length_km;

disp("Total capacitance of each conductor for 100 km (F) = " + string(C_total));
```

OUTPUT :

```
Scilab 2026.0.0 Console                                                    ? ⤢ X
 "Capacitance per conductor per meter (F/m) = 1.008D-11"
 "Capacitance per conductor per kilometer (F/km) = 1.008D-08"
 "Total capacitance of each conductor for 100 km (F) = 0.000001"
```

EX NO 7. CALCULATION OF CAPACITANCE OF AN UNSYMMETRICAL THREE PHASE LINE BUT TRANSPOSED USING SCILAB

a) A 3-phase, 50 Hz, 66 kV overhead line conductors are placed in a horizontal plane as shown in Fig. The conductor diameter is 1·25 cm. If the line length is 100 km,calculate (i) capacitance per phase, (ii) charging current per phase, assuming complete transposition of the line..

SOURCE CODE:

```
clc;

clear;


// ------------------------------------------------

// Given data

// ------------------------------------------------

d1 = 2;              // spacing D12 in meters

d2 = 2;              // spacing D23 in meters

d3 = 4;              // spacing D31 in meters


dia = 1.25e-2;       // diameter in meters

r = dia / 2;         // radius in meters


Vline = 66;          // kV

f = 50;              // Hz

length_km = 100;     // km


epsilon0 = 8.854e-12;    // F/m


// ------------------------------------------------

// Equivalent spacing (for transposed line)

// ------------------------------------------------
```

Deq = (d1 * d2 * d3)^(1/3);

// --

// *Capacitance per phase per meter*

// --

C_per_m = 2 * %pi * epsilon0 / log(Deq / r);

disp("Capacitance per phase per meter (F/m) = " + string(C_per_m));

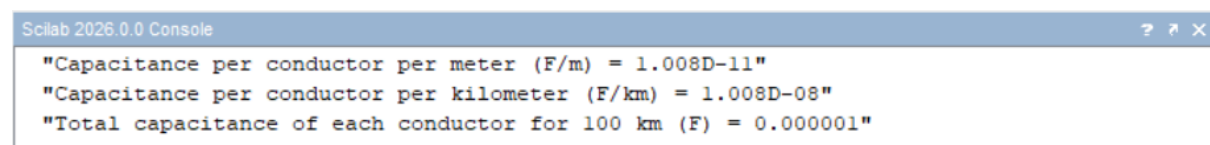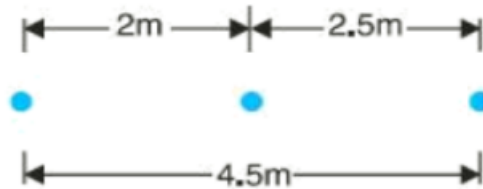// *Capacitance per phase per km*

C_per_km = C_per_m * 1000;

disp("Capacitance per phase per km (F/km) = " + string(C_per_km));

// *Capacitance per phase for 100 km*

C_100km = C_per_km * length_km;

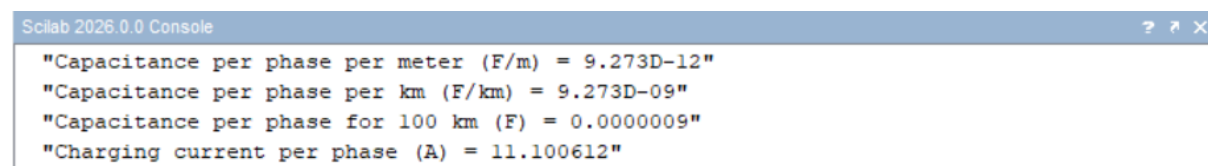disp("Capacitance per phase for 100 km (F) = " + string(C_100km));

// --

// *Charging current per phase*

// --

V_phase = (Vline * 1000) / sqrt(3);

Ic = 2 * %pi * f * C_100km * V_phase;

disp("Charging current per phase (A) = " + string(Ic));

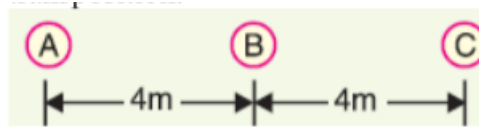**OUTPUT :**

```
Scilab 2026.0.0 Console                                          ?  ⇗  ✕
  "Capacitance per phase per meter (F/m) = 9.273D-12"
  "Capacitance per phase per km (F/km) = 9.273D-09"
  "Capacitance per phase for 100 km (F) = 0.0000009"
  "Charging current per phase (A) = 11.100612"
```

b) A 3-phase, 50 Hz, 132 kV overhead line has conductors placed in a horizontal plane 4 m apart. Conductor diameter is 2 cm. If the line length is 100 km, calculate the charging current per phase assuming complete transposition.

SOURCE CODE:

clc;

clear;

// Given data

d1 = 4;   *// spacing D12 in meters*

d2 = 4;   *// spacing D23 in meters*

d3 = 8;   *// spacing D31 in meters*

dia = 2e-2;   *// diameter in meters*

r = dia / 2;   *// radius in meters*

Vline = 132;   *// kV*

f = 50;   *// Hz*

length_km = 100;   *// km*

epsilon0 = 8.854e-12;   *// F/m*

// Equivalent spacing (transposed line)
Deq = (d1 * d2 * d3)^(1/3);

// Capacitance per phase per meter
C_per_m = 2 * %pi * epsilon0 / log(Deq / r);

disp("Capacitance per phase per meter (F/m) = " + string(C_per_m));

// Capacitance per phase per km

C_per_km = C_per_m * 1000;

disp("Capacitance per phase per km (F/km) = " + string(C_per_km));

// Capacitance per phase for 100 km

C_100km = C_per_km * length_km;

disp("Capacitance per phase for 100 km (F) = " + string(C_100km));

// Phase voltage

V_phase = (Vline * 1000) / sqrt(3);

// Charging current per phase

Ic = 2 * %pi * f * C_100km * V_phase;

disp("Charging current per phase (A) = " + string(Ic));

OUTPUT :

```
Scilab 2026.0.0 Console                                          ?  ⊼  ✕
 "Capacitance per phase per meter (F/m) = 8.940D-12"
 "Capacitance per phase per km (F/km) = 8.940D-09"
 "Capacitance per phase for 100 km (F) = 0.0000009"
 "Charging current per phase (A) = 21.405073"
```

EX NO 9. CALCULATION OF TRANSMISSION LINE PARAMETERS USING END CONDENSER METHOD USING SCILAB

a) A (medium) single phase transmission line 100 km long has the following constants : Resistance/km = 0·25 Ω ; Reactance/km = 0·8 Ω Susceptance/km = 14 × 10 −6 siemen ; Receiving end line voltage = 66,000 V, Assuming that the total capacitance of the line is localised at the receiving end alone, determine (i) the sending end current (ii) the sending end voltage (iii) regulation and (iv) supply power factor. The line is delivering 15,000 kW at 0.8 power factor lagging.

SOURCE CODE:

clc;

clear;

// Line parameters per km

R_per_km = 0.25;   // ohm/km

X_per_km = 0.8;   // ohm/km

B_per_km = 14e-6;   // siemens/km

length = 100;   // km

// Receiving end data

Vr_line = 66000;   // Line voltage (V)

P_load = 15000;   // Power (kW)

pf_load = 0.8;   // Lagging

// Total line parameters

R_total = R_per_km * length;

X_total = X_per_km * length;

B_total = B_per_km * length;

Z_total = R_total + %i * X_total;

```
disp("Total resistance of the line (ohm) = " + string(R_total));

disp("Total reactance of the line (ohm) = " + string(X_total));

disp("Total susceptance of the line (S) = " + string(B_total));

disp("Total impedance of the line = " + string(Z_total));


// Per-phase values

Vr_phase = Vr_line / sqrt(3);

P_total = P_load * 1000;        // W

P_phase = P_total / 3;


// Receiving end current

Ir = P_phase / (Vr_phase * pf_load);

disp("Receiving end current (A) = " + string(Ir));


// Load angle

theta_load = acos(pf_load);


// Current components

Ir_real = Ir * cos(theta_load);

Ir_reactive = Ir * sin(theta_load);


disp("Receiving end current (complex) = " + string(Ir_real - %i*Ir_reactive));


// Capacitive current (per phase)

Ic = Vr_phase * B_total;

disp("Capacitive current (A) = " + string(Ic));


// Sending end current
```

```
Is_real = Ir_real;

Is_reactive = -Ir_reactive + Ic;

Is = sqrt(Is_real^2 + Is_reactive^2);


disp("Sending End Current (A) = " + string(Is));
```

// Sending end voltage (per phase)

```
Vs_phase = Vr_phase + Is * Z_total;

Vs_line = abs(Vs_phase) * sqrt(3);


disp("Sending End Voltage (V) = " + string(Vs_line));
```
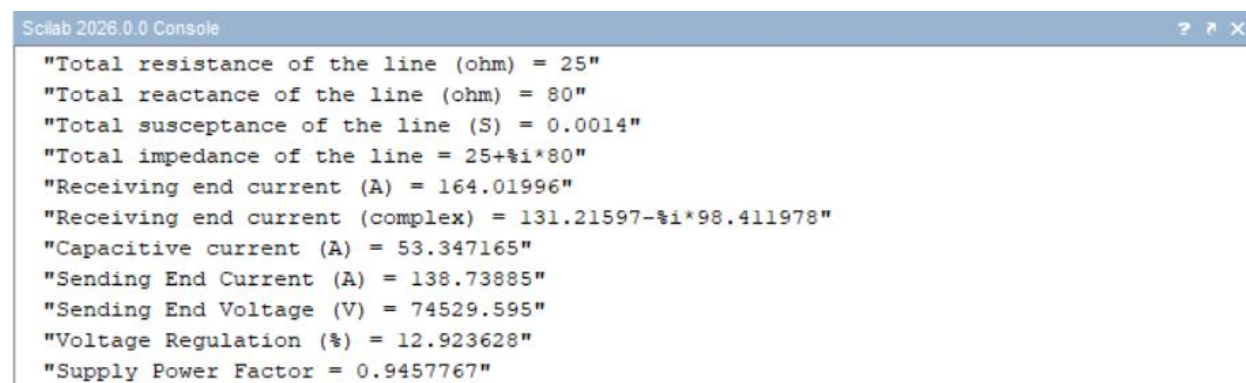
// Voltage regulation

```
regulation = ((Vs_line - Vr_line) / Vr_line) * 100;

disp("Voltage Regulation (%) = " + string(abs(regulation)));
```

// Sending end power factor

```
pf_supply = Is_real / Is;

disp("Supply Power Factor = " + string(pf_supply));
```

OUTPUT :


```
Scilab 2026.0.0 Console                                          ?  ↗  ✕
  "Total resistance of the line (ohm) = 25"
  "Total reactance of the line (ohm) = 80"
  "Total susceptance of the line (S) = 0.0014"
  "Total impedance of the line = 25+%i*80"
  "Receiving end current (A) = 164.01996"
  "Receiving end current (complex) = 131.21597-%i*98.411978"
  "Capacitive current (A) = 53.347165"
  "Sending End Current (A) = 138.73885"
  "Sending End Voltage (V) = 74529.595"
  "Voltage Regulation (%) = 12.923628"
  "Supply Power Factor = 0.9457767"
```

EX NO 10. CALCULATION OF TRANSMISSION LINE PARAMETERS U S I N G

NOMINAL−T METHOD USING SCILAB

a) A 3-phase, 50-Hz overhead transmission line 100 km long has the following constants : Resistance/km/phase = 0.1 Ω, Inductive reactance/km/phase = 0·2 Ω, Capacitive susceptance/km/phase = 0·04 × 10 − 4 siemen. Determine (i) the sending end current (ii) sending end voltage (iii) sending end power factor and (iv) transmission efficiency when supplying a balanced load of 10,000 kW at 66 kV, p.f. 0·8 lagging.   Use   nominal   T   method.

SOURCE CODE:

clc;

clear;

// Given data

R_km_phase = 0.1;   *// ohm/km/phase*

Xl_km_phase = 0.2;   *// ohm/km/phase*

B_km_phase = 0.04e-4;   *// mho/km/phase*

L = 100;   *// line length (km)*

VR_line = 66000;   *// Receiving end line voltage (V)*

VR_phase = VR_line / sqrt(3);

disp("Receiving end voltage per phase (V) = " + string(VR_phase));

S_load = 10000 * 1e3;   *// Load power (W)*

pf_load = 0.8;

theta_R = acos(pf_load);

// Line parameters

R = R_km_phase * L;

XL = Xl_km_phase * L;

Y = %i * B_km_phase * L;

```
disp("Total Resistance (ohm) = " + string(R));

disp("Total Reactance (ohm) = " + string(XL));

disp("Total Susceptance (mho) = " + string(Y));


// Receiving end current magnitude

IR = S_load / (sqrt(3) * VR_line * pf_load);

disp("Receiving end current magnitude (A) = " + string(IR));


// Impedance

Z = R + %i * XL;


// Receiving end current phasor

IR_angle = -theta_R;

IR_phasor = IR * exp(%i * IR_angle);

disp("Receiving end current (complex) = " + string(IR_phasor));


// Mid-point voltage

VC = VR_phase + IR_phasor * (Z / 2);


// Charging current

IC = Y * VC;


// Sending end current

IS = IR_phasor + IC;

disp("Sending end current IS (A) = " + string(abs(IS)));


// Sending end voltage

VS = VC + IS * (Z / 2);

disp("Sending end voltage VS (kV) = " + string(abs(VS) / 1000));
```

// Sending end power factor

theta_S = atan(imag(IS) / real(IS));

pf_S = cos(theta_S);

disp("Sending end power factor = " + string(pf_S));

// Power & efficiency

P_sending = 3 * abs(VS) * abs(IS) * pf_S;

P_received = S_load;

efficiency = (P_received / P_sending) * 100;

disp("Transmission efficiency (%) = " + string(efficiency));

OUTPUT :

```
Scilab 2026.0.0 Console                                          ? ↗ X
  "Receiving end voltage per phase (V) = 38105.118"
  "Total Resistance (ohm) = 10"
  "Total Reactance (ohm) = 20"
  "Total Susceptance (mho) = %i*0.0004"
  "Receiving end current magnitude (A) = 109.34664"
  "Receiving end current (complex) = 87.477314-%i*65.607985"
  "Sending end current IS (A) = 100.53321"
  "Sending end voltage VS (kV) = 40.151204"
  "Sending end power factor = 0.8679581"
  "Transmission efficiency (%) = 95.141903"
```

EX NO 11. CALCULATION OF TRANSMISSION LINE PARAMETERS USING NOMINAL−Π

METHOD USING SCILAB

a) A 3-phase, 50Hz, 150 km line has a resistance, inductive reactance and capacitive shunt admittance of 0·1 Ω, 0·5 Ω and 3 × 10−6 S per km per phase. If the line delivers 50 MW at 110 kV and 0·8 p.f. lagging, determine the sending end voltage and current. Assume a nominal π circuit for the line.

SOURCE CODE:

```
clc;

clear;


// Line parameters

R = 0.1 * 150;        // ohms

X = 0.5 * 150;        // ohms

Y = 3e-6 * 150;       // mho


// Receiving end data

Vr = 110e3 / sqrt(3);   // phase voltage (V)

Pr = 50e6;            // total power (W)

pf = 0.8;


// Receiving end current

Ir_mag = Pr / (3 * Vr * pf);

phi_r = acos(pf);


// Receiving end current phasor

Ir = Ir_mag * (cos(-phi_r) + %i * sin(-phi_r));


// Charging current at receiving end

Ic1 = %i * (Y / 2) * Vr;
```

// Line current

Il = Ir + Ic1;

// Line impedance

Z = R + %i * X;

// Sending end phase voltage

Vs = Vr + Il * Z;

Vs_line = abs(Vs) * sqrt(3);

// Charging current at sending end

Ic2 = %i * (Y / 2) * Vs;

// Sending end current

Is = Il + Ic2;

// Display results (YOUR REQUIRED FORMAT)

disp("Phase Sending End Voltage (V) = " + string(abs(Vs)));

disp("Line-to-Line Sending End Voltage (V) = " + string(Vs_line));

disp("Magnitude of Receiving End Current (A) = " + string(abs(Ir)));

disp("Magnitude of Line Current (A) = " + string(abs(Il)));

disp("Magnitude of Sending End Current (A) = " + string(abs(Is)));

OUTPUT :

```
Scilab 2026.0.0 Console                                              ? ↗ ✕
  "Phase Sending End Voltage (V) = 82885.561"
  "Line-to-Line Sending End Voltage (V) = 143562"
  "Magnitude of Receiving End Current (A) = 328.03993"
  "Magnitude of Line Current (A) = 319.67074"
  "Magnitude of Sending End Current (A) = 306.38482"
```

EX NO 12. CALCULATION OF STRING EFFICIENCY FOR AN INSULATOR STRING USING SCILAB

a) A 3-phase transmission line is being supported by three disc insulators. The potentials across top unit (i.e., near to the tower) and middle unit are 8 kV and 11 kV respectively. Calculate (i) the ratio of capacitance between pin and earth to the self-capacitance of each unit (ii)the line voltage and (iii) string efficiency.

SOURCE CODE:

clc;

clear;

V1 = 8;   // *Voltage across first disc (kV)*

V2 = 11;   // *Voltage across second disc (kV)*

n = 3;   // *Number of discs*

// *Ratio of capacitances*

k = (V2 / V1) - 1;

// *Voltage across third disc*

V3 = V2 + (V1 + V2) * k;

// *Total voltage across string*

V_total = V1 + V2 + V3;

// *Line voltage*

V_line = 1.732 * V_total;

// *String efficiency*

string_efficiency = (V_total / (n * V3)) * 100;

// Display results (your required format)

disp("Ratio of capacitance C0/C = " + string(k));

disp("Line Voltage (kV) = " + string(V_line));

disp("String Efficiency (%) = " + string(string_efficiency));

OUTPUT :

```
Scilab 2026.0.0 Console                                              ?  ↗ X
 "Ratio of capacitance C0/C = 0.375"
 "Line Voltage (kV) = 64.3005"
 "String Efficiency (%) = 68.275862"
```

EX NO 13. CALCULATION OF INTERSHEATH VOLTAGE ON UG CABLES USING SCILAB.

a) A single core cable of conductor diameter 2 cm and lead sheath of diameter 5.3 cm is to be used on a 66 kV, 3-phase system. Two intersheaths of diameter 3·1 cm and 4·2 cm are introduced between the core and lead sheath. If the maximum stress in the layers is the same, find the voltages on the intersheaths.

SOURCE CODE:

clc;

clear;

d = 2;

d1 = 3.1;

d2 = 4.2;

D = 5.3;

// *Phase voltage*

V_phase = 66 * sqrt(2) / sqrt(3);

// *Maximum stress factors*

g1_max_factor = 2.28;

g2_max_factor = 2.12;

g3_max_factor = 2.04;

// *Voltage ratios*

V1_ratio = g1_max_factor / g2_max_factor;

V2_ratio = g1_max_factor / g3_max_factor;

// *Voltage distribution*

V = V_phase;

V1 = V / (1 + V1_ratio + V2_ratio);

V2 = V1 * V1_ratio;

V3 = V1 * V2_ratio;

// Intersheath voltages

Voltage_first_intersheath = V - V1;

Voltage_second_intersheath = V - V1 - V2;

// Display results (YOUR FORMAT)

disp("Voltage on first intersheath = " + string(Voltage_first_intersheath));

disp("Voltage on second intersheath = " + string(Voltage_second_intersheath));

OUTPUT :

```
Scilab 2026.0.0 Console                                                    ?  ↗ ✕
 "Voltage on first intersheath = 37.012241"
 "Voltage on second intersheath = 18.862008"
```

EX NO 14. CALCULATION OF SAG WITH SUPPORTS ARE AT EQUAL LEVELS USING SCILAB

a) An overhead transmission line with a span of 250 meters is subjected to a tension of 750 kg out of a total capacity of 1500 kg. The conductor has a uniform weight of 1000 N/m. Determine the maximum sag in the conductor, assuming it follows a parabolic shape due to its weight.

SOURCE CODE:

clc;

clear;

L = input("Enter span length (m) = ");

T = input("Enter tension (kg) = ");

// Weight range

W = 0.75:0.05:1;

// Sag calculation

S = (W .* L^2) / (8 * T);

// Plot

plot(W, S);

xlabel("Weight of conductor (kg)");

ylabel("Sag (m)");

title("Calculation of Sag with Various Conductor Weights");

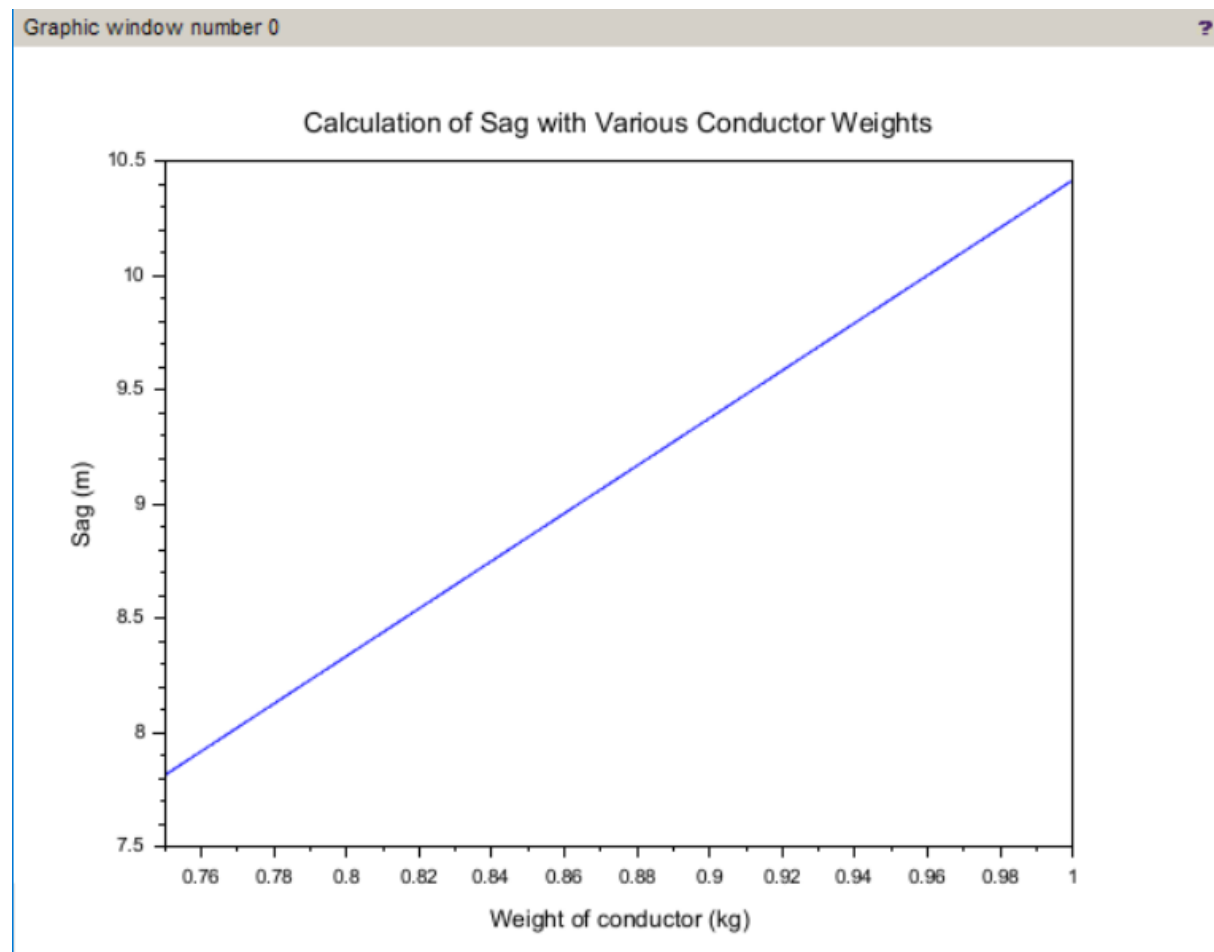// Display sag values

disp("Sag values (m) = " + string(S));

OUTPUT :

```
Enter span length (m) = 250

Enter tension (kg) = 750

        column 1 to 2
 "Sag values (m) = 7.8125"  "Sag values (m) = 8.3333333"
        column 3 to 4
 "Sag values (m) = 8.8541667"  "Sag values (m) = 9.375"
        column 5 to 6
 "Sag values (m) = 9.8958333"  "Sag values (m) = 10.416667"
```

Graphic window number 0   ?

b) A 132 kV transmission line has the following specifications: conductor weight = 680 kg/km, span length = 260 m, ultimate strength of the conductor = 3100 kg, and a safety factor = 2. Determine the height above the ground at which the conductor must be supported, ensuring a minimum ground clearance of 10 meters.

SOURCE CODE:

clc;

clear;

L = input("Enter span length (m) = ");

Tu = input("Enter ultimate strength = ");

FOS = input("Enter factor of safety = ");

// Working tension

T = Tu / FOS;

// Weight range

W = 0.68:0.02:0.9;

// Sag calculation

S = (W .* L^2) / (8 * T);

// Plot

plot(W, S);

xlabel("Weight of conductor (kg)");

ylabel("Sag (m)");

title("Calculation of Sag with Various Conductor Weights");

// Display sag values

disp("Sag values (m) = " + string(S));

OUTPUT :

```
Scilab 2026.0.0 Console                                                    ?  ⁊  X

Enter span length (m) = 260

Enter ultimate strength = 3100

Enter factor of safety = 2

        column 1 to 2
  "Sag values (m) = 3.7070968"   "Sag values (m) = 3.816129"
        column 3 to 4
  "Sag values (m) = 3.9251613"   "Sag values (m) = 4.0341935"
        column 5 to 6
  "Sag values (m) = 4.1432258"   "Sag values (m) = 4.2522581"
        column 7 to 8
  "Sag values (m) = 4.3612903"   "Sag values (m) = 4.4703226"
        column 9 to 10
  "Sag values (m) = 4.5793548"   "Sag values (m) = 4.6883871"
        column 11 to 12
  "Sag values (m) = 4.7974194"   "Sag values (m) = 4.9064516"
```
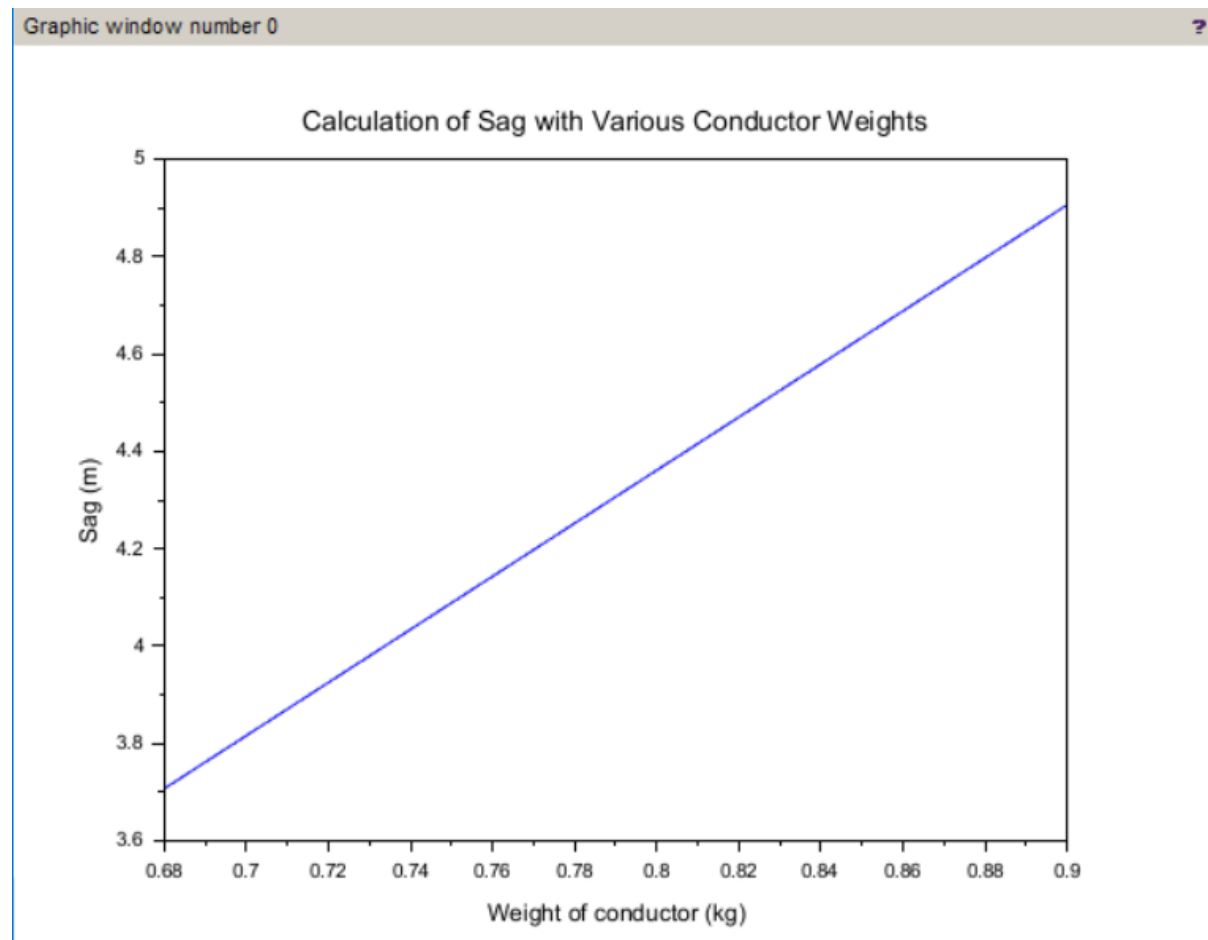

Graphic window number 0

Calculation of Sag with Various Conductor Weights

EX NO 15. CALCULATION OF SAG WITH SUPPORTS ARE AT UNEQUAL LEVELS AND WITH WIND & ICE COATING USING SCILAB

a) Two towers, with heights of 30 m and 90 m, support a transmission line conductor over a water crossing. The horizontal distance between the towers is 500 m, and the tension in the conductor is 1600 kg. The conductor has a weight of 1.5 kg/m. Assuming the bases of the towers are at water level, calculate: The minimum clearance of the conductor from the water surface and the clearance at the midpoint between the supports.

SOURCE CODE:

clc;

clear;

// Inputs

L = <u>input</u>("Span length = ");

W = <u>input</u>("Weight (kg/m) = ");

h = <u>input</u>("Height = ");

T = <u>input</u>("Tension = ");

// Solving simultaneous equations

A = [1 1; -1 1];

B = [500; 256];

x = A \ B;

x1 = x(1);

x2 = x(2);

disp("x1 = " + string(x1));

disp("x2 = " + string(x2));

// Sag at lowest point O

S = (W * x1^2) / (2 * T);

Clr1 = 30 - S;

disp("Clearance of lowest point O from water level = " + string(Clr1));

// Sag at midpoint P

mid = 250 - x1;

Smid = (W * mid^2) / (2 * T);

disp("Sag at midpoint P = " + string(Smid));

// Clearance at midpoint

Clr2 = Clr1 + Smid;

disp("Clearance of midpoint P from water level = " + string(Clr2));

OUTPUT :

```
Scilab 2026.0.0 Console                                           ? ↗ X

Span length = 500

Weight (kg/m) = 1.5

Height = 30

Tension = 15696

  "x1 = 122"
  "x2 = 378"
  "Clearance of lowest point O from water level = 29.2888"
  "Sag at midpoint P = 0.7828746"
  "Clearance of midpoint P from water level = 30.071674"
```

b) A to line has a span of 275 m between level supports. The conductor has an effective diameter of 1.96 cm & diameter and weights o.865 kg/m. its ultimate strength is 8060kg. If the conductor has the coating of radial thickness 1.27 cm &is subjected to a wind pressure of 3.9 gm/m 2 of projected area calculate sag for a safety factor 2 weight of 1c of ice is 0.91 gm.

SOURCE CODE:

```
clc;

clear;


// Inputs

L  = input("Span length (m) = ");

d  = input("Diameter of conductor (cm) = ");

W  = input("Weight of conductor (kg/m) = ");

Tu = input("Ultimate strength (kg) = ");

t  = input("Radial thickness of ice (cm) = ");

p  = input("Wind pressure (kg/m^2) = ");


// Working tension

T = Tu / 2;


// Volume of ice per meter (cm^3)

V = %pi * t * (d + t) * 100;

disp("Volume of ice per metre (cm^3) = " + string(V));


// Weight of ice per meter (kg)

Wi = 0.91 * V;

disp("Weight of ice per metre (kg) = " + string(Wi));


// Wind force per meter (kg)

Ww = p * ((d + 2*t) * 100);

disp("Wind force per metre (kg) = " + string(Ww));


// Resultant weight
```

Wt = sqrt((W + (Wi / 1000))^2 + (Ww / 1000)^2);

disp("Total weight of the conductor (kg/m) = " + string(Wt));

// *Sag calculation*

S = (Wt * L^2) / (8 * T);

disp("Sag (m) = " + string(S));

OUTPUT :

```
Scilab 2026.0.0 Console                                                ? ↗ X

Span length (m) = 275

Diameter of conductor (cm) = 1.96

Weight of conductor (kg/m) = 0.865

Ultimate strength (kg) = 8060

Radial thickness of ice (cm) = 1.27

Wind pressure (kg/m^2) = 3.9

  "Volume of ice per metre (cm^3) = 1288.7127"
  "Weight of ice per metre (kg) = 1172.7286"
  "Wind force per metre (kg) = 1755"
  "Total weight of the conductor (kg/m) = 2.6893053"
  "Sag (m) = 6.3082726"
```