Answer the Following Questions:

**Q1**   15

A single-circuit 3-phase 50 Hz 400 kV line has a series reactance per phase of 0.327 ohm/km. Neglect line resistance. The line is 400 km long and the receiving-end load is 600 MW at 0.9 p.f. lag. The positive-sequence line capacitance is 7.27 nF/km. In the absence of any compensating equipment connected to ends of line, calculate the sending-end voltage. Work with and without considering line capacitance. The base quantities for calculation are 400 kV, 1000 MVA.

Q2   20

For the network shown in the figure, the speeds of propagation in the OHTL and the cable are 3 μs/km and 6 μs/km respectively. Draw the Lattice diagram up to 360 μs. Calculate the voltage at the midpoint of the cable at 300 μs.

OHTL	Cable	OHTL
20 km Z_o=200Ω	20 km Z_o=40Ω	Each line 40 km Z_o=160Ω

V=90 kV
Z_s = 0.0
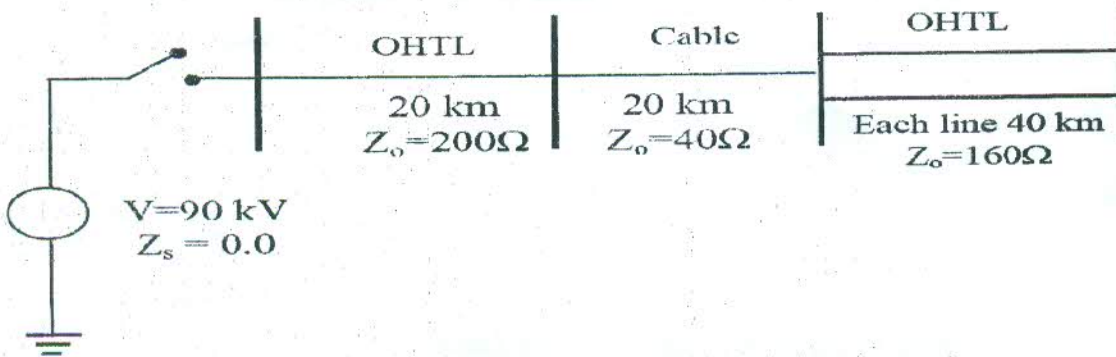
Q3   15

A single smooth conductor 2 cm in radius is strung 6 meters above ground; using Peek's formula for corona-inception gradient, find (a) the corona-inception voltage, (b) the equivalent radius of conductor to the outside of the corona envelope at 18% overvoltage. Take δ =1.

Q4   **20**

Design **with economical consideration** and take into account all verifications of the arrester with the new technique for Egyptian Unified Grid "E. U. G" for 400 kV line voltages. Use the accompanied tables for the old and new design tables. (Take $V_a = 0.8$ V_m).

Q5   **20**

1.   State the typical HVDC applications.   (5)
2.   What are the types of HVDC transmission system?   (5)
3.   (10)

The following test result under dry conditions were obtained on a 500-kV tower for positive switching surges with 23 units of $5\frac{3}{4} \times 10$ insulators in a tower window of 11 meters (5.5 meter clearance when string is vertical).

(i) Single string. CFO = 1340 kV crest, withstand voltage at 3s f down = 1100 kV.

(ii) Double string. CFO = 1390 kV, 3sf down = 1250 kV.

For the two cases, calculate:

(a) % sf /CFO;

(b) The maximum allowable p.u. switching surge based on operating voltage of 525 kV

End of Exam Questions, Good Luck
Dr. fathallaselim