Code.No: 07A70205 | R07 | SET-1

IV B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010
EHV AC TRANSMISSION
(ELECTRICAL AND ELECTRONICS ENGINEERING)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

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1.a) Give ten levels of transmission voltages that are used in the world.
b) What is the necessity of EHV AC Transmission? Explain its advantages. [16]

2.a) Explain the Inductance effect on:
i) Round conductor with internal and external flux linkages.
ii) Flux linkage calculation of 2-conductor line.
b) A 345-kV line has an ACSR Bluebird conductor 1.762 inches (0.04477 m) in diameter with an equivalent radius for inductance calculation of 0.0179 m. The line height is 12 m. Calculate the inductance per km length of conductor and the error caused by neglecting the internal flux linkage. [16]

3. A sphere gap with the spheres having radii R = 0.5 m has a gap of 0.5 m between their surfaces.
i) Calculate the required charges and their locations to make the potentials 100 and 0.
ii) Then calculate the voltage gradient on the surface of the high-voltage sphere.
iii) If the partial breakdown of air occurs at 30 kV/cm peak, calculate the disruptive voltage between the spheres. [16]

4.a) What is Corona-loss formulae and explain the available formulae classification?
b) What are the different formulas for the corona current explain in detail? [16]

5.a) Describe the mechanism of formation of a positive corona pulse train.
b) The positive and negative corona pulses can be assumed to be square pulses of amplitudes 100 mA and 10 mA respectively. Their widths are 200 ns and 100 ns respectively. Their repetition rates are 1000 pps and 10,000 pps. The bandwidth of a filter is 5 kHz. Calculate the ratio of output of the filter for the two pulse trains at a tuned frequency f_0 = 1 MHz. [16]

6.a) Explain the classification of shock currents?
b) Explain the effect of Electrostatic fields to human life, plants and animals? [16]

7.a) Explain the clear difference between Traveling and Standing wave theory?
b) Derive the differential expression and their solutions for a transmission line with distributed Inductance and capacitance.
c) What is the importance of Bewley Lattice diagram and explain with neat example. [16]

8.a) What is the purpose and significance of power circle diagram and its uses and also explain in detail the receiving end circle diagram for calculating reactive compensation for voltage control buses?
b) Define compensation and explain Cascade connection of components of shunt series compensation with generalized equations and chain rule? [16]

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EHV AC TRANSMISSION
(ELECTRICAL AND ELECTRONICS ENGINEERING)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

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1.a) Explain in detail power-handling capacity of a.c. transmission lines and line losses?

b) A power of 2000 MW is to be transmitted from a super thermal power station in Central India over 800 km to Delhi. Use 400 kV and 750 kV alternatives. Suggest the number of circuits required with 50% series capacitor compensation, and calculate the total power loss and loss per km. [16]

2. Explain the following:
   i) Single-phase line for capacitance calculation
   ii) Multi-conductor line for calculation of Maxwell's potential coefficients.
   iii) Potential coefficients for Bundled-Conductor Lines. [16]

3. Explain the surface voltage gradient on:
   a) Single conductors
   b) 2-conductor bundle above ground
   c) Distribution of voltage gradient on 2-conductor bundle illustrating the cosine law. [16]

4.a) Explain charge-Voltage(q-V) diagram and Corona Loss for:
   i) Increase in Effective Radius of Conductor and Coupling Factors
   ii) Charge-Voltage Diagram with Corona.

b) An overhead conductor of 1.6 cm radius is 10 m above ground. The normal voltage is 133 kV r.m.s to ground (230 kV, line-to-line). The switching surge experienced is 3.5 p.u. Taking K = 0.7, calculate the energy loss per km of line. Assume smooth conductor. [16]

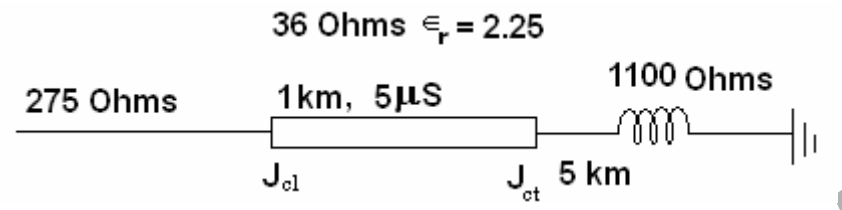
5.a) How Corona Pulses are going to generate and explain their properties?

b) State and explain different formulae used to calculate the power loss due to corona on E. H.V. lines. [16]

6.a) How does the electric field at ground level influence tower design? Also explain significance of Electric field stress (voltage gradient) Potential at ground level?

b) Explain the effect of electric field intensity nearer to conductor surface and nearer to ground surface with respect to E.H.V. lines. [16]

7. A 750-kV transmission line has a surge impedance of 275 ohms and the transformer to be connected to it has a surge impedance of 1100 ohms for its h.v. winding. The length of winding of 5 km and its far end is connected to a zero resistance ground. A surge of 2400 kV is coming in the line which is to be limited to 1725 kV at the transformer bushing by using a short cable as shown in figure.
   a) Calculate the surge impedance and voltage rating of the cable to be interposed between line and transformer.
   b) Calculate the voltage at the h.v. terminal of the winding as soon as the first reflection arrives from the grounded end. [16]



8. Explain the voltage control in E.H.V.A.C. lines by using shunt and series compensation method. [16]

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IV B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010
EHV AC TRANSMISSION
(ELECTRICAL AND ELECTRONICS ENGINEERING)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
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1.a) What are the different mechanical considerations in line performance and explain in detail?
b) What are the properties of Bundled conductors and explain with neat sketches? [16]

2. What is the use of Symmetrical Components for analyzing 3-phase problems and explain Inductance & Capacitance Transformation to Sequence Quantities. [16]

3.a) Explain the voltage gradient distribution on Six-conductor bundle and gradient on sub-conductor.
b) A point charge Q = 10^{-6} coulomb ($1\,\mu$C) is kept on the surface of a conducting sphere of radius r = 1 cm, which can be considered as a point charge located at the centre of the sphere. Calculate the field strength and potential at a distance of 0.5 cm from the surface of the sphere. Also find the capacitance of the sphere, $\varepsilon_r = 1$. [16]

4.a) How Audible Noise frequency spectra affects ac and dc transmission lines, and what are the limits for audible noise?
b) Explain different types of Audible Noise measurement and meters. [16]

5. A D/C 400-kV line has the three conductors of one circuit at heights 13 m, 23 m and 33 m above ground. The horizontal spacing between conductors on the tower are 14 m, 16 m and 14m between phases A1-C2, B1-B2 and C1-A2 respectively as shown in figure 1. The two-conductor bundles of each phase have conductors with diameters 3.18 cm each at a bundle spacing of 45.72 cm. At a point on ground 15 meters away from the line centre, evaluate the total RI level at 1 MHz in fair weather at 420 kV. [16]

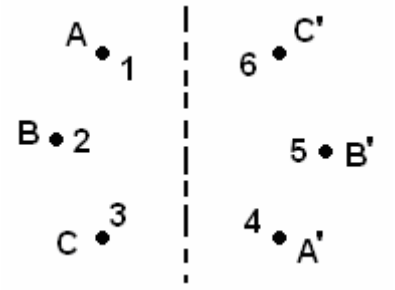

Figure 1

6. A 230 kV DC line has the dimensions shown in figure 2. The phase conductor is a single Drake 1.108 inch (0.028 m) diameter. Calculate the voltage induced in conductors of circuit 2 when circuit 1 is energized assuming
i) no transposition and ii) full transposition.

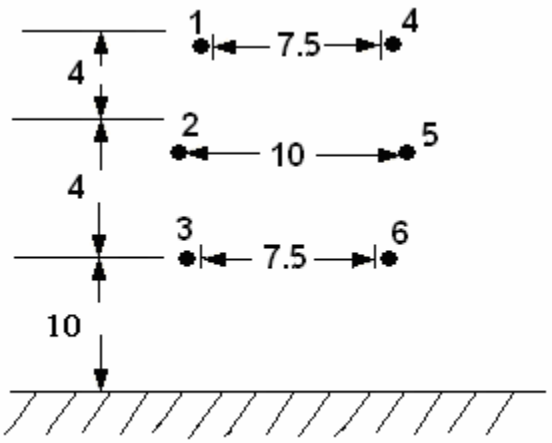

Figure 2: DC 230 kV line Dimensions [16]

7. Calculate the expected p.u. value of load-end voltage for various line lengths from 100 km to 1000 km at no-load. Neglect line resistance and assume source-end voltage to be held constant at 1 p.u. [16]

L, km	100	200	300	400	500	600	700	800	900	1000
$(2\pi L/\lambda)^0$	6^0	12^0	18^0	24^0	30^0	36^0	42^0	48^0	54^0	60^0
$\cos(2\pi L/\lambda)^0$	0.9945	0.978	0.951	0.9135	0.866	0.809	0.743	0.669	0.588	0.5
Er / Es	1.0055	1.022	1.05	1.095	1.155	1.236	1.346	1.494	1.7	2

8. Explain how Harmonics are injected into Network by TCR under:
a) Harmonic Injection by TCR in to high voltage system
b) Connection of TCR to Δ and Y connected transformer windings
c) Voltage and current wave forms for $\alpha = 90^0$, $\alpha > 90^0$ for calculations of harmonics? [5+5+6]

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EHV AC TRANSMISSION
(ELECTRICAL AND ELECTRONICS ENGINEERING)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
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1.a) Explain the following:
i) The effect of conductor resistance of e.h.v lines.
ii) Power Loss in Transmission.
iii) Skin Effect Resistance in Round Conductors.

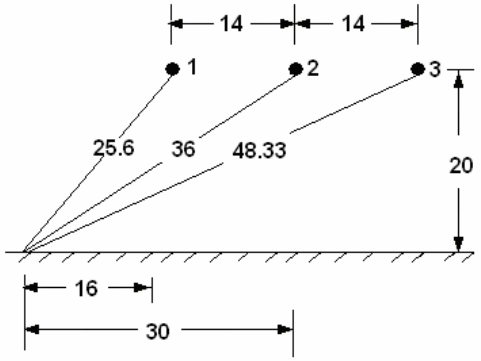
b) The configurations of some e.h.v lines for 400 kV to 1200 kV are given. Calculate r_{eq}. for each.
i) 400 kV : N = 2, d = 2r = 3.18 cm, B = 45 cm
ii) 750 kV : N = 4, d = 3.46 cm, B = 45 cm
iii) 1000 kV : N = 6, d = 4.6 cm, B = 12 d
iv) 1200 kV : N = 8, d = 4.6 cm, R = 0.6 m. [16]

2. What are different modes of propagation for line parameters with and without Transposition? [16]

3. Derive general expression for the charge-potential relations for multi conductor lines:
i) Maximum Charge Condition on a 3-Phase Line.
ii) Numerical values of Potential Coefficients and charge of Lines. [16]

4.a) What is the relation between Single-Phase and 3-Phase Audible Noise levels?

b) A 735 kV line has the following details:
N = 4, d = 3.05 cm, B = bundle spacing = 45.72 cm, height H = 20 m, phase separation S = 14 m in horizontal configuration. By the Mangoldt formula, the maximum conductor surface voltage gradients are 20 kV/cm and 18.4 kV/cm for the centre and outer phases, respectively. Calculate the SPL or AN in dB (A) at a distance of 30 m along ground from the centre phase (line centre). Assume that the microphone is kept at ground level. [16]



735 kV line configuration

5. a) Write short notes on frequency spectrum of the RI field of line in E.H.V. lines.
   b) Draw the circuit diagram for measuring Radio Influence Voltage (RIV) with respect to E.H.V. lines. [16]

6.a) Convert the B-values given in the table into H-values:

Exposure Hours	1	2	3	4	5	6	7	8
B-Field, Gauss	754	616	503	402	314	251	201	176

   b) Explain how a body beneath the tower/line, within a ROW, away from conductors and insulated from ground gets charged? [16]

7. Explain the traveling wave concept for step response of transmission line:
   i) Losses neglected
   ii) Losses and attenuation included. [16]

8.a) Explain Shunt Reactor Compensation of Very Long Line with Intermediate Switching Station and give the Voltage and current expression at Intermediate station.
   b) Find the generalized constants for transmission line with series-Capacitor Compensation at middle of line. [16]

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