B 1249

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2006.

Eighth Semester

Electrical and Electronics Engineering

EE 035 — EHV AC AND DC TRANSMISSION ENGINEERING

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the factors on which the power that can be transmitted through an EHV line depends?

2. What is meant by Galloping of a conductor?

3. Why a steel core is preferred for the conductors?

4. How are Bundle spacing and Bundle radius defined?

5. Calculate the surge impedance loading of a 750 kV line of the surge impedance is 300 ohms.

6. Name the different SVC schemes.

7. Draw the corona current waveform.

8. How is Radio Influence Voltage measured?

9. How are unepolar links different from Homopolar links?

10. What is meant Extinction angle control?

PART B — (5 × 16 = 80 marks)

11. (i) A power of 12,000 MW is required to be transmitted over a distance of 1000 kM. Determine the current and total line losses if the magnitude of both the sending end and receiving end voltages are 750 kV, with a 30° phase difference in the voltages between the sending end and receiving end. (4)

(ii) Discuss about the factors that cause vibrations on EHV conductors. (4)

(iii) Describe the theory of acolian vibrations and wake induced oscillations on EHV conductors and suggest measures to minimise the damage due to them. (8)

12. (a) (i) Derive the capacitance matrix of an n conductor system. (8)

(ii) A 3 phase 750 kV horizontal line has a minimum height of 12 m, sag at midspan equal to 12 m, phase spacing equal to 15 m. The conductor's are 4×0.035 m in diameter, with a bundle spacing of 0.4572 m. Calculate per Kilometer the capacitance matrices for untransposed and transposed configurations. (8)

Or

(b) (i) Develop expressions for the inductances for the three modes of propagation of electromagnetic energy of the waves generating them. (8)

(ii) Show that the velocity of wave propagation in the line to ground mode is $\frac{1}{\sqrt{(L_S + 2L_m + 3L_g)(C_s + 2C_m)}}$. (8)

13. (a) A 750 kV line has distributed line constants $r = 0.025$ ohm/km, $l = 0.9$ mH/km, and $c = 12.3$ nF/km. At 50 Hz, calculate for a line of 600 km in length.

(i) A, B, C, D constants. (4)

(ii) Charging current and MVAR at a receiving end voltage of 750 kV line-line on no load. (6)

(iii) The co-ordinates of the centre of the receiving end power circle diagram. (6)

Or

(b) (i) Explain how series capacitor compensation helps to increase the power handling capacity of the transmission line. (10)

(ii) Bring out the harmful effects of series capacitor compensation. (6)

14. (a) Design a 400 kV, 200 kM, 1000 MW EHV transmission line. Assume all other relevant data. (16)

Or

(b) (i) Discuss the effect of temperature on Breakdown stress of insulation of EHV cables. (6)

(ii) A 500 kV XLPE cable is requried to be designed under the following Conditions Maximum Working Voltage 550 kV rms $l-l$.

Test voltages $V_{ac} = 1100$ kV rms $l-n$, $V_{imp} = 220$ kV peak without lightning arrester.

Average electric stresses E_{ac} 30 kV/mm, $E_{imp} = 65$ kV/mm.

Area of conductors 2000 mm^2, No central oil duct.

(1) Calculate the diameter to the outside of the insulation for least value of maximum stress and the magnitude of the stress on the conductor surface

(2) If the actual value of $t\,i$ (Insulation thickness) is 35 mm based on impulse strength, calculate the maximum and average stresses in the insulation.

(3) At a current density of 0.8 Amp/mm^2, find the power transmitted at 550 kV. (10)

15. (a) (i) Bring out the advantages and disadvantages of HVDC over HVAC transmission. (6)

(ii) Develop the equivalent circuit of HVDC system. (4)

(iii) Discuss the effects of uncharacteristic harmonics. (6)

Or

(b) (i) Explain the electrical characteristics of EHV cables. (6)

(ii) Describe using diagrams the operation of a lightning arrester and surge absorber suitable for HVDC systems. (10)