B.E.Eighth Semester (Electrical Engineering (Electronics & Power)) (C.B.S.)

Elective - II : EHVAC & HVDC Transmission System

P. Pages : 3 **NKT/KS/17/7574**

Time : Three Hours * 0 5 2 9 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.

1. a) Derive an expression for Maxwell's potential coefficient of a 1ϕ line considering the effect of ground. **6**

b) A power of 1200 mw is required to be transmitted over a distance of 1000 km at vtg levels of 400 kv and 750 kV. Determine : **7**

i) Possible No. of ckts required with equal magnitude for sending & receiving end vtg with 30° phase difference

ii) The current to be transmitted

iii) Total line losses.

The values of r & x are.

kv	r (Ω/km)	x (Ω/km)
400	0.031	0.327
750	0.0136	0.272

OR

2. a) Explain & derive cosine law of variation of surface vtg gradient of bundled conductors. **7**

b) A 735 kv line has N=4, r=0.0176 m B = 0.4572 m for bundled conductor of each phase. The line height & phase spacing in horizontal configuration are H = 15m, S = 15m, Calculate the max. surface vtg. Gradients on the centre phase & outer phases using Mangoldt formula. **6**

N - No. of bundled conductors,
r - radius of subconductor
B - Bundle spacing

3. a) Describe the difference between primary shock current & secondary shock current. What is the meaning of let go current. **6**

b) Find the corona inception voltage for 3ϕ, 110V, overhead transmission line consisting of 3 stranded copper conductors spaced 2.5 m apart at the corner of an equilateral triangle air temp. & press are 21°C & 73.6 cm of Hg resp. The conductor diameter is 10.4 mm **8**

(Assume $\varepsilon_0 = 8.854 \times 10^{-12}$)

i) Find the effective diameter of the conductor at an overvoltage of 2.5 p.u.

ii) Compare the capacitance in both cases.

OR

4. a) What is charge vtg. diagram ? Derive the expression for $P_C = \frac{1}{2} kC\left(V_m^2 - V_o^2\right)$ for corona a energy loss from a charge vtg diagram. **5**

b) Describe the effect of electrostatic field on human beings, plants & animals. **4**

c) Explain the calculation of electrostatic field of single ckt 3-phase line. **5**

5. a) What is the purpose of earth electrode ? What factors are considered while selecting the site for earth electrode. **7**

b) Write short note on : **6**

i) Parallel MTDC system.

ii) Kinds of DC links.

OR

6. a) Compare HVDC & EHVAC transmission system. **6**

b) A DC link has a loop resistance of 10 Ω & is connected to x^{mers} giving secondary vtg of 120 kv at each end. The bridge connected converters operate as follows : **7**
Rectifier $\rightarrow$ α = 15°, X = 15Ω
Inverter $\rightarrow$ $\delta_0 = 10°$, $\gamma = 15°$, $X = 15\Omega$
Allow 5° margin on δ_0 for δ . Calculate the direct current delivered if inverter operates on constant ignition angle control.

7. a) What are the objectives of operating DC link in parallel with AC line ? Explain how these objectives are achieved ? **6**

b) In the context of converter explain : **8**
i) Commutation margin
ii) Ignition angle
iii) Overlap angle
iv) Current margin

OR

8. a) Draw & explain the const. current & const. extinction angle control characteristics (CC-CEA) of HVDC system. **6**

b) In context of HVDC converter explain - **8**
i) Current margin (ΔI_d)
ii) Min. Extinction angle (δ_0)

9. a) Explain the effect of delay angle α & extinction angle on reactive power. **6**

b) Describe the methods of compensation of reactive power in HVDC system. **7**

OR

10. a) On what factor is the reactive power requirement of a converter station depend. **6**

b) Compare single tuned filter & Double tuned filter in all respect. **7**

11. a) Explain HVDC substation protection schemes. **6**

b) Describe the term switching energy how is the commutation principle is used for HVDC ckt. Breaker. **7**

OR

12. a) Write short notes on.

i) Insulation coordination of HVDC system. **4**

ii) Surge protection of HVDC substation. **4**

iii) MRTB & its switching sequence. **5**

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