B.E. Electrical (Electronics & Power) Engineering Seven Semester

EP7051 - Elective-I : EHV AC-DC Transmission

P. Pages : 4 **GUG/W/18/1778**

Time : Three Hours * 1 3 8 9 * Max. Marks : 80

Notes :
1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Diagrams should be given wherever necessary.
5. Illustrate your answers wherever necessary with the help of neat sketches.
6. Use of Non programmable electronic calculator is permitted.

1. a) What are the factor's that decide the power handling capacity of A.C Transmission line. **4**

b) A power of 5000 MW is to be transmitted from a super thermal power station in Chandrapur over a distance of 800 Km to Mumbai, use 400 kV & 750 kV alternatives, & suggest the **8**

1) Possible Number of circuit Required. 2) Current Transmitted.
3) Total line losses 4) Percentage line losses.

Find the number of circuit's required in each case with 30% series capacitor compensation, Assume the values of r and x as follow's.

kV	r Ω /Km/phase	x Ω /km/phase
400kV	0.031	0.327
750kV	0.0136	0.272

c) Derive an Expression for Maxwell's potential co-efficient of a single-phase line considering the effect of ground. **4**

OR

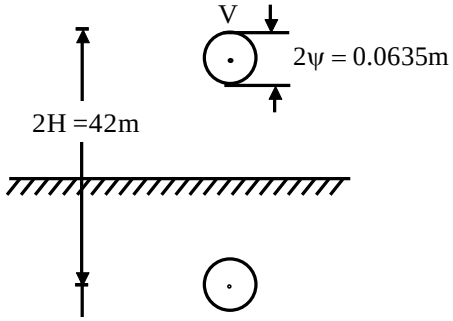
2. a) A single-conductor E.H.V Transmission line strung above ground is used for Experimental purpose to investigate High-voltage effect's. The conductor is expanded ACSR with diameter of 2.5 inches (0.0635m) and the line Height is 21 metres above ground. **8**

i) Calculate the voltage to ground which will make it's surface voltage gradient equal to corona-inception gradient given by Peek's formula.

$$E_{or} = \frac{30}{\sqrt{2}} \frac{1}{m} \left(1 + \frac{0.301}{\sqrt{\psi}}\right) KV/cm \text{ .r.m.s}$$

Where m = 1.3 required for stranding.

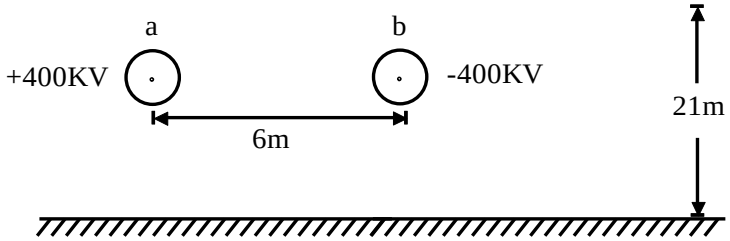
ii) Find the charging current and MVAR of the single - phase Transformer for Exciting 1 Km length of the experimental line.



b) Derive an Expression related to the cosine law of voltage gradient for two bundled conductors? **4**

c) A single circuit Transmission line is placed above ground to study the High voltage effect, the conductor's are ACSR with diameter 0.0635 m & separated by a distance of 6m, The line Height is 21m above ground, **4**

a) Find Maxwell's potential co-efficient
b) Find charge co-efficient, if voltages are $\pm$ 400 KV
c) Check weather corona takes place on the surface of the conductor.



3. a) Describe the difference between primary shock current and secondary shock current, what is the meaning of 'let-go' current? **4**

b) Describe different Method's for the measurement of electrostatic field's? **4**

c) What is the effect of High electrostatic field on human being's, animal's and plant's? **4**

d) Explain electromagnetic interference of EHV-lines on the Neighboring lines? **4**

OR

4. a) What do you understand by 'critical Disruptive voltage' and 'visual critical voltage'. **4**

b) A 3-phase, 66KV overhead transmission line consist of the standard copper conductor's spaced 2.5 m apart at the Corner's of an Equilateral triangle, Air temperature & pressure are 21ºC & 73.6 cm of Hg, the conductor's diameter is 10.4 mm, **8**

1) Find the corona inception voltage
2) Find the effective dimeter of the conductor at an over voltage of 2.5 PU
3) Compare the capacitance in both the cases,
4) Compute complete energy loss per Km of line.

c) Discuss in detail, the factor's affecting Corona loss? **4**

5. a) A New Bipolar D.C system is compared with a 3-phase A.C system, If **8**

$Pd/Pa = K_1$, $(P_L)_d/(P_L)_a = K_2$

$Ra/Rd = K_3$, & Cos ϕ

is the p. f of the A.C system.

show that;

$$\frac{\text{D.C Insulation level}}{\text{A.C Insulation level}} = \frac{0.867\,K_1 \cos\phi}{\sqrt{K_2\,K_3}}$$

b) State the factor's to be considered in selecting a site of Earth electrode. **4**

c) State the different Kind's of HVDC link's along with their application's. **4**

OR

6. a) Explain the configuration of a typical parallel converter Multi-Terminal HVDC system, and also state it's advantages as compared with conventional A.C interconnected system. **8**

b) Give different configuration, and types of MT-HVDC system. **8**

7. a) Draw the control characteristic's of converter, explain the operation of converter under different load condition using the control characteristic's. **4**

b) Differentiate between constant current control and CEA control, what control are used on rectifier side and inverter side of operation? **4**

c) A D.C link has loop resistance of 5Ω and is connected to a transformer giving secondary voltage of 110 Volt's at each end, the Bridge connected converter operation as follow's, Rectifier $\alpha = 15^{o}$,Inverter $\delta_0 = 10^{o}$,Allow 5^{o} margin on δ_0 for δ, $X = 10\Omega$, Determine the direct current delivered if the inverter operates on constant $'\beta'$. **8**

OR

8. a) Derive an Expression for the reactive power requirement of HVDC converter's? How these requirement's are Met? **8**

b) A rectifier has No-load ideal D.C voltage Udio equal to 276.75 KV, The D.C current is 1.5 KA, The actual D.C voltage Ud is 250 KV, Calculate the reactive power absorbed by the rectifier. **4**

c) What is the effect of Delay angle (α) and Extinction angle (γ) on reactive power of converter. **4**

9. a) How the commutation principle is used for HVDC CB explain it? **4**

b) Explain various types of HVDC circuit Breaker? **4**

c) A 2-Terminal HVDC pole is operating with 500 KV D.C at rectifier end, A D.C line fault occur's very near to rectifier Terminal station, the fault resistance is only 1 ohm, calculate D.C fault current, If the D.C smoothing reactor is Ls = 0.5H, what would be the energy dissipated in the fault, assuming the rectifier is blocked immediately after occurrence of the fault? **4**

d) Describe the function of Metallic return transfer CB (MRTB). **4**

OR

10. a) Explain the Method of sensing and clearing of a pole to earth fault on D.C side of converter. **4**

b) Write short note on insulation co-ordination and protective Margin of HVDC system. **4**

c) A pole to Earth fault Occur's Near the rectifier terminal of a 500 KV HVDC pole, the D.C smoothing reactor has an inductance of 0.8 H, calculate the rated switching energy required for an HVDC Breaker in the D.C pole, Assume the fault resistance to be $0.5\,\Omega$ **4**

d) With the help of a suitable diagram. Describe the pole wise segregation of the protective zones is Bipolar HVDC system. **4**

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