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NEW SCHEME

Eighth Semester B.E. Degree Examination, May / June 2006
Electrical and Electronics Engineering
HVDC Transmission

Time: 3 hrs.]

[Max. Marks:100

Note: 1. Answer any FIVE full questions.

1. a. Compare AC and DC transmission on the basis of,
 i) Economics of transmission ii) Technical performance iii) Reliability. (10 Marks)
 b. Mention important applications of DC transmission. (03 Marks)
 c. Draw the schematic diagram of a typical HVDC converter station and explain the various components. (07 Marks)
2. a. Discuss the procedure involved in the selection of optimum system voltage for a fixed power transfer in case of,
 i) Long distance bulk power transmission
 ii) Interconnection between adjacent systems. (05 Marks)
 (Back to back DC ties)
 b. What is a Graetz circuit? Why it is accepted as the best 6 pulse converter configuration? (04 Marks)
 c. With reference to HVDC converter system control:
 i) Bring out the limitations of manual control
 ii) Discuss on current and voltage control. (05 Marks)
 d. Compute valve utilization factor for the following 6 pulse converter configurations:
 i) $q = 3, r = 1, s = 2$ ii) $q = 6, r = 1, s = 1$ (06 Marks)
3. a. Derive an expression for average DC voltage in a Graetz circuit without overlap. How this expression gets modified, when an overlap of less than 60° exists? (07 Marks)
 b. Explain basic characteristic of a converter controller. (04 Marks)
 c. A Graetz circuit operating at 50 Hz has a line to line voltage of 440 V. Considering AC line inductance ' L_c ' = 1 Henry, $\alpha = 15^\circ$ and $u = 10^\circ$.
 Compute:
 i) Average current and voltage
 ii) Equivalent Communication resistance.
 Also draw the equivalent circuit of the bridge converter. (09 Marks)

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- 4 a. With regard to HVDC converter control system, explain clearly:
- Constant minimum ignition angle control
 - Constant current control
 - Constant extinction angle control. (10 Marks)
- b. Explain a power controller in a HVDC converter. (05 Marks)
- c. What are the basic types of faults that can occur in a HVDC converter? Briefly explain commutation failure. (05 Marks)
- 5 a. Explain the causes for over voltages in a converter station. (05 Marks)
- b. What are the basic principles of over voltages protection in a DC system? (04 Marks)
- c. List the various functions of a smoothing reactor. (04 Marks)
- d. A current on the DC line of a converter is to be interrupted by a breaker. For a system voltage of 500 V, DC current of 100 A, Breaker Counter voltage of 1000 V and DC line inductance of 1 Henry, compute the energy absorbed by the breaker and time required to bring to zero. Also draw the relevant circuit diagram. (07 Marks)
- 6 a. Distinguish between characteristic and non characteristic harmonics. (06 Marks)
- b. What is the main design objective of AC filters? Explain the different types of AC filters. (06 Marks)
- c. For a 12 pulse converter unit shown below, in fig.6C, neglecting overlap, find:
- Expression for ' i_A '
 - RMS values of fundamental component and 2nd order harmonic current. (08 Marks)
- Assume $I_d = 100$ A.

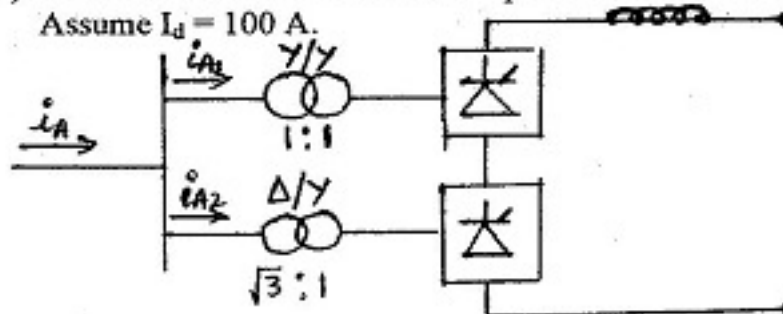


Fig.6C

- 7 a. Name the various tools that can be employed for simulation of a dynamic system. Which is the widely used tool in HVDC system simulation? (03 Marks)
- b. What is a HVDC simulator (physical model)? Summarize applications of a DC simulator. (05 Marks)
- c. What is digital dynamic simulation? Bring out its merits and demerits. (05 Marks)
- d. Explain: i) value and converter model ii) controller modeling. (07 Marks)
- 8 Write brief notes on the following:
- Modern trends in DC transmission.
 - Surge arrestors
 - Parity Simulator.
 - Requirements of a good simulation tool. (20 Marks)
