EE834

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NEW SCHEME

Eighth Semester B.E. Degree Examination, Dec.06 / Jan.07
Electrical and Electronics Engineering
HVDC transmission

Time: 3 hrs.] [Max. Marks:100

Note: ***1. Answer any FIVE full questions.***

1 a. List the advantages and disadvantages of HVDC transmission. **(08 Marks)**
b. Mention the applications of DC transmission. **(06 Marks)**
c. Explain the recent trends in HVDC transmission. **(06 Marks)**

2 a. Explain the simplified analysis of Graetz circuit without overlap. **(03 Marks)**
b. Derive an expression, in the above circuit, for the D.C. voltage, and the rms value of the fundamental component of AC line current. Also show $\cos\phi = \cos\alpha$. **(09 Marks)**
c. A Graetz circuit is fed by a transformer and the pertaining data are :
Output voltage per phase of transformer = 100 kV (rms) ;
Reactance per phase of transformer = 5% ;
Transformer power rating = 100 MVA ;
Firing angle $\alpha = 30^\circ$,
Overlap angle $u = 30^\circ$,
Calculate load current, terminal voltage on D.C. side. **(08 Marks)**

3 a. Discuss the merits and demerits of constant current versus constant voltage control of power in a HVDC system. **(05 Marks)**
b. State the desired features of control for HVDC system. **(05 Marks)**
c. A bipolar HVDC link rated at ± 500 kV, 500 MW is delivering 400 MW, at the inverter end. The AC voltage at the inverter end is 400 kV having commutating resistance of 2Ω and DC voltage of ± 475 kV. Calculate
i) Excitation angle of inverter.
ii) Voltage at rectifier.
iii) Length of DC line.
iv) Power at rectifier.
Given loss in DC line is 12 MW and resistance is 10 mΩ per km. **(10 Marks)**

4 a. What are the various kinds of DC links? Draw the figures and briefly explain. **(05 Marks)**
b. Explain the basic principle of DC link control with the help of equivalent circuit for 2 terminal DC link in steady state. **(05 Marks)**
c. Draw the combined characteristic of rectifier and inverter and briefly explain. **(05 Marks)**
d. Explain constant current characteristic with the help of schematic diagram. **(05 Marks)**

5 a. Mention the different types of faults that can occur in converters. **(02 Marks)**
b. Describe commutation failure and its effects. **(06 Marks)**

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5 c. What are the basic principles of over current protection in D.C. systems? Draw the schematic diagram for over current protection in a pole. **(06 Marks)**

d. Explain the causes of over voltages in a converter station. **(06 Marks)**

6 a. List the functions of smoothing reactor. **(05 Marks)**

b. Find the inductance of the DC reactor required to prevent consequent commutation failure in the inverter described below.
Number of bridges per pole = 2
Rated voltage per bridge = 200 kV
Rated current = 1.8 kA
I_{S2} = 10 kA
Frequency = 60 Hz. **(06 Marks)**

c. What are the major problems in the current interruption in DC circuits? **(04 Marks)**

d. List the problems associated with the injection of harmonics from HVDC converters into AC system and D.C. line. **(05 Marks)**

7 a. Define the following relating to criteria of design of harmonic filters.
i) Harmonic distortion.
ii) Telephone influence factor.
iii) Telephone harmonic form factor. **(09 Marks)**

b. List the various types of AC filters used. **(03 Marks)**

c. Draw the circuit diagram and impedance characteristics as a function of the frequency of the above filters. **(06 Marks)**

d. What is the main difference in the design criteria of AC and DC filters? **(02 Marks)**

8 a. What are the requirements of a good simulation tool? **(04 Marks)**

b. List some of the problems that can be studied using a DC simulator. **(04 Marks)**

c. What are the main advantages and disadvantages of digital simulation? **(06 Marks)**

d. Explain briefly the three different ways of modeling a valve / converter for digital dynamic simulation. **(06 Marks)**

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