CBCS Scheme

USN | | | | | | | | | | |

16EPS/EPE41

Fourth Semester M.Tech. Degree Examination, June/July 2018

HVDC Power Transmission

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Explain the advantages of HVDC transmission over HVAC transmission. **(06 Marks)**

b. Draw a neat sketch of organization of HVDC systems. Give the function of its basic components. **(06 Marks)**

c. Write short notes on HVDC system reliability. **(04 Marks)**

OR

2 a. Develop the equivalent circuit of a 3-phase converter working as rectifier with an overlap angle μ and delay angle α. Hence, show that the equivalent resistance of the converter is $\frac{3WL_C}{\pi}$. **(08 Marks)**

b. Calculate the secondary line voltage of a transformer for three phase bridge rectifier to provide a DC voltage of 120 KV. Assume $\alpha = 30°$, $\mu = 15°$. What is the effective reactance, if the rectifier gives 800 A of DC output current. **(04 Marks)**

c. Draw the schematic diagram of a 12 pulse converter. What are the different modes of operation of it? **(04 Marks)**

Module-2

3 a. What are the various sources for generation of harmonics in HVDC systems? Mention the effects caused due to the presence of harmonics. **(04 Marks)**

b. Draw the wave shape of currents of the primary side of star-star and star-delta 3-phase 12 pulse converter transformer, and obtain an expression for current on the primary side in terms of harmonics. **(08 Marks)**

c. What are the different types of filters used on the AC side of an HVDC system? Explain the design of active power filter. **(04 Marks)**

OR

4 a. With necessary diagrams explain the individual phase control and equidistant pulse control schemes used for firing angle control of converter. **(08 Marks)**

b. Write a short note on commutation failure in HVDC converter. **(02 Marks)**

c. With the help of block diagram and characteristics explain the principle of conventional HVDC control. **(06 Marks)**

Module-3

5 a. State and explain the HVDC system control functions using hierarchical control scheme. **(08 Marks)**

b. Compare various types of reactive power compensators with respect to response time, temporary over voltage and capacity. **(08 Marks)**

OR

6 a. Define short circuit ratio and effective short circuit ratio of an HVDC system. **(04 Marks)**

b. With neat diagram explain the interaction between HVDC and HVAC system. **(06 Marks)**

c. Explain the interaction between HVDC system and FACTS devices. **(06 Marks)**

Module-4

7 a. With sketches explain the methods of various gate triggering circuits in HVDC converter. **(06 Marks)**

b. What are the design constraints of HVDC converter transformer? **(04 Marks)**

c. Explain any one method of cooling HVDC thyristor valves. **(06 Marks)**

OR

8 a. Write short notes on bipolar HVDC overhead line. **(04 Marks)**

b. Mention the types of cable used in HVDC system. Explain the design of any one cable. **(08 Marks)**

c. What are the noise sources of a HVDC station? **(04 Marks)**

Module-5

9 a. Give the principles of various AC side apparatus protection in HVDC system from fault. **(06 Marks)**

b. Explain the concept of protection by control actions in an HVDC system with a neat sketch. **(06 Marks)**

c. With the help of block diagram explain fault analysis according to a valve fault in HVDC converter. **(04 Marks)**

OR

10 a. With neat sketches explain the operation of different types of Multi Terminal (MTDC) systems. **(08 Marks)**

b. With the diagram, write the principle of operation of voltage source converter of HVDC systems in offshore application. **(06 Marks)**

c. What are the advantages of 800 KV HVDC systems? **(02 Marks)**

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