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Question Paper Code : 52940

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Eighth Semester

Electrical and Electronics Engineering

EE 6010 — HIGH VOLTAGE DIRECT CURRENT TRANSMISSION

(Regulation 2013)

(Common to PTEE 6010 — High Voltage Direct Current Transmission for B.E. Part Time – Seventh Semester – Electrical and Electronics Engineering – Regulations 2014)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Name the three important HVDC projects in operation in India.

2. What are the potential applications of MTDC systems?

3. State the advantages of higher pulse number of a convener.

4. What are the three main categories of converter topologies suitable for HVDC power transmission?

5. Mention the two basic requirements for the firing pulse generation of HVDC valves.

6. State the objective of Voltage Dependent Current Order Limiter (VDCOL) in the basic power controller used in HVDC system.

7. Define Harmonics and THD.

8. Mention the principle of shunt APF.

9. List out constraints to be considered in the AC power flow analysis.

10. Mention the factors influencing the modeling requirements of DC systems.

PART B — ($5 \times 13 = 65$ marks)

11. (a) (i) Enumerate the demerits of DC transmission. How are they overcome? (5)

(ii) Describe how the modern trends in HVDC technology improve the reliability and performance of HVDC transmission system. (8)

Or

(b) (i) Mention the different types of DC links and compare their merits and demerits. (6)

(ii) Explain the operating principle of a VSC based HVDC system. State the advantages of VSC based HVDC system compared to CSC based HVDC system. (7)

12. (a) (i) Explain why Graetz circuit is considered as the best circuit for a six pulse converter. (9)

(ii) Develop the expression for the average direct voltage of a six pulse converter operating in two and three valve conduction mode. (4)

Or

(b) A 3-phase, 12-pulse rectifier is fed from a transformer with nominal voltage ratings of 220 kV / 110 kV.

(i) If the primary voltage is 230 kV and the effective turns ratio T is 0.48, determine the dc output voltage when the delay angle α is 20° and the commutation angle μ is 18°.

(ii) If the direct current delivered by the rectifier is 2000 A, calculate the effective commutating reactance Xc, RMS fundamental component of alternating current, power factor and reactive power at the primary side of the transformer.

13. (a) (i) With the help of steady-state equivalent circuit, explain the principles of a two terminal DC link control. (7)

(ii) With neat voltage waveforms, describe the process of de-energization and energization of a HVDC converter bridge. (6)

Or

(b) (i) Draw and explain the Equidistant Pulse Control based constant current control system for HVDC line.

(ii) Explain the functions of emergence power controller / auxiliary controller used for controlling power in a DC link. (7)

14. (a) (i) Describe how the alternate control methods affect the reactive power requirements of the HVDC converter. (6)

(ii) Explain the basic configuration and characteristics of Thyristor Controlled Reactor (TCR). (7)

Or

(b) (i) Explain the design procedure for a minimum cost single tuned filter to be used on the AC side in a HVDC line. (6)

(ii) Describe the various criteria for judging the effectiveness of a DC filter. (7)

15. (a) (i) Obtain the relationship between per unit quantities in DC and AC systems. (7)

(ii) Classify the solution methodology for AC and DC power flow. Describe any one methodology with a neat flowchart. (6)

Or

(b) Draw and explain the functional block diagram of an HVDC system model.

PART C — (1 × 15 = 15 marks)

16. (a) Explain the working of STATCOM in mitigating the steady state stability.

Or

(b) Explain how the mitigating performance of a shunt APF differs from a series APF.

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