W 2691

M.E. DEGREE EXAMINATION, JANUARY 2007.

Elective

Power Systems Engineering

PS 1622 — HIGH VOLTAGE DIRECT CURRENT TRANSMISSION

(Common to M.E. Power Electronics and Drives)

(Regulation 2005)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the factors to be considered when the relative merits of two modes of transmission ie AC and DC are planned?

2. Draw the characteristic of the power carrying capacity of an A.C line as a function of distance in comparison with D.C. line.

3. Define converter configuration.

4. What are the assumptions made for obtaining the fast steady-state solution of the system equations of HVDC converters?

5. Why the feed back control of power in a D.C. link is not desirable?

6. What are the two basic firing schemes used in Firing Angle Control?

7. List the problems associated with the injection of harmonics in HVDC converters.

8. What are the reasons which produce non-characteristic harmonics in HVDC converters?

9. What are the tools that can be employed for the simulation of a dynamic system?

10. Give any two advantages of digital simulation.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Draw different configurations of asynchronous interconnection of HVAC and HVDC systems. (8)

   (ii) Show diagrammatically "the selection of optimum system voltage for a fixed power transfer". (8)

Or

   (b) (i) What are the disadvantages of D.C. transmission and give the significant advances in D.C. technology to overcome the disadvantages? (8)

   (ii) What are the applications of D.C. transmission over A.C. transmission and give block diagrams of three D.C. link configurations. (8)

12. (a) Analize a six pulse converter with filters and formulate state equations using equivalent circuit with 1, 2, 3 conducting valves. (16)

Or

   (b) Describe D.C. voltage waveform, A.C. current waveform and power factor for no overlap condition of Graetz circuit. (16)

13. (a) (i) With a steady state equivalent circuit of a 2-terminal D.C. link, derive the value of steady-state current I_d. (8)

   (ii) Illustrate with figures for converter controller characteristic of both stations and also for negative current margin condition. (8)

Or

   (b) (i) Explain Hierarchical control structure for a D.C. Link. (8)

   (ii) With block diagram explain power and auxiliary controller. (8)

14. (a) With a schematic diagram of a 12-pulse converter unit, calculate the characteristic harmonic and show harmonics with variation in D.C. current. (16)

Or

   (b) (i) Discuss carrier frequency and RI noise in HVDC converter stations and configuration of PLC/RI filter and its attenuation requirements. (8)

   (ii) Draw and explain variation of INV along D.C. lines. (8)

15. (a) (i) List out the number of system studies to design a HVDC system. (8)

(ii) Explain Parity Simulator and give major advantages of parity simulator. (8)

Or

(b) Explain modelling of HVDC systems for digital dynamic simulation using diagrams for

(i) Converter bridge

(ii) Current injection at the converter bus

(iii) D.C. network and

(iv) Valve model. (16)

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