



- (b) (i) What are the types of HVDC Links, with neat diagrams, explain?(8)  
(ii) State the advantages and disadvantages of series and parallel MTDC systems. (8)

12. (a) What are the three modes of six-pulse Graetz converter? Explain the complete analysis of model operation of the converter for overlap angle ( $\mu$ ) less than  $60^\circ$ . (16)

Or

- (b) Describe the six-pulse converter bridge characteristics as rectifier, and explain the different modes of operation of a 12-pulse converter for rectification. (6 + 10)

13. (a) (i) Draw the complete steady-state equivalent circuit of a two terminal DC link and obtain the expression for the steady-state current in it. (8)  
(ii) With a neat schematic diagram, explain the direct control scheme of HVDC-VSC system. (8)

Or

- (b) (i) Explain the necessity of constant extinction angle control of inverters and describe how such control can be accomplished. (8)  
(ii) Write down the start-up procedure of DC link with  
(1) long-pulse firing, and  
(2) short-pulse firing. (8)

14. (a) Explain the reactive power requirements of the HVDC converter in steady state and how they are affected by the converter control methods. (6 + 10)

Or

- (b) (i) Describe the effects of firing angle errors on the non-characteristic harmonics. (6)  
(ii) Explain the design of minimum cost tuned AC filter. (10)

15. (a) Derive the mathematical modelling of HVDC links for power flow analysis. (16)

Or

- (b) With a neat flow chart, explain the solution methodologies for AC-DC power flow. (16)