

- N.B. : (1) Question No.1 is compulsory.
(2) Attempt any three from remaining.
(3) Figures to the right indicate full marks.

1. Solve any four :

- (a) Draw different types of HVDC links.
(b) Draw the equivalent circuit of HVDC line.
(c) Explain IPC scheme of firing of HVDC Converter bridge.
(d) Give classification of faults in HVDC.
(e) State causes and consequences of harmonics in HVDC.

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2. (a) For a bridge converter with grid control and overlap less than 60° Prove that

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$$\cos \phi \cong \cos \alpha - \frac{R_c \cdot I_d}{V_{do}}$$

(b) Explain single commutation with neat diagram and waveform.

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3. (a) Calculate the secondary line voltage of the transformer for a three phase bridge rectifier to provide dc voltage of 120KV. Assume $\alpha = 30^\circ$ and $\mu = 15^\circ$. What is the effective reactance? when the rectifier gives 800A of dc current.

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(b) Discuss desired features of control of HVDC and explain basic control characteristic

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4. (a) Explain with neat diagrams and waveforms the principle of 12 pulse converter.

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(b) Explain the importance of current margin.

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5. (a) Write a note on 'Ground return'.

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(b) Write a note on 'Power reversal in HVDC'.

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6. (a) Explain over voltage and over current protection of HVDC.

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(b) Write a note on 'Harmonics and filters in HVDC'.

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