National Institute of Technology, Delhi

Name of the Examination: B. Tech.

Mid-Semester Examination March, 2019

Branch : EEE   **Semester** : VIII

Title of the Course : HVDC & Flexible AC Transmission Systems   **Course Code** : EEL-451

Time: 2 Hours   **Maximum Marks: 25**

Note : All questions are compulsory

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1. i) Give a comparison between HVDC system with EHVAC system based on economics, technical performance and reliability when bulk power is transmitted over a long distance. **(2)**

   ii) Why the three-phase bridge circuit is invariably used for conversion and inversion in HVDC system? **(1)**

   iii) Why commutation failure problem is frequency in inverter operation? Explain with the help of waveform. **(2)**

2. i) An HVDC bipolar link using a 6-pulse converter is supplying power of 500 MW at 100KV. The rectifier station is working at a delay angle $\alpha=15°$. Estimate a) no load voltage b)AC voltage on the converter side of the transformer **(2)**

   ii) A 3-phase fully controlled bridge converter is connected to a 400V, 50Hz supply having a source reactance of 0.3Ω/ph. The converter is operating at a firing angle of 70°. Determine the average load voltage and the overlap angle when the converter is supplying a steady current of 125A. **(3)**

3. a) Explain the terms:
   i) Commutation group
   ii) pulse numbers applied to HVDC converters **(1)**

   b) Sketch the voltage and current waveforms for Graet'z circuit (consider 2nd and 3rd valves are conducting and 4th valve is to be triggered) when
   i) $\alpha=30°$, $\mu=15°$ ii) $\alpha=120°$, $\mu=75°$ iii) $\gamma=15°$ (neglect overlap) **(4)**

4. Develop the equivalent circuit of a converter working as rectifier with an overlap angle μ and delay angle α for three/four valve conduction mode. Also, determine the equivalent resistance of the converter. **(5)**

5. Compare three phase one way rectifier with three-phase two way rectifier with respect to peak inverse voltage and volt ampere rating of transformer bank. Draw neat sketches and derive the expression used for both cases. **(5)**