Code No: **R1642022** **R16** **Set No. 1**

IV B.Tech II Semester Regular/Supplementary Examinations, July - 2021

HVDC TRANSMISSION

(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B

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PART–A *(14 Marks)*

1. a) State the merits of HVDC transmission over EHVAC transmission for bulk power transmission. [2]
   b) What are the five modes of region of rectifier operation of a 12-pulse converter? [2]
   c) Distinguish between delay in firing angle (α) and extinction angle(γ) of an HVDC converter. [3]
   d) List out the sources of reactive power in HVDC system. [2]
   e) What are the sources of generation of harmonics. [2]
   f) How is a filter designed? What are the different types of Ac filters. [3]

PART–B *(4x14 = 56 Marks)*

2. a) What are the different types of HVDC links? Discuss them with necessary diagrams. [6]
   b) With a neat schematic diagram, state the various apparatus required for HVDC station and explain the purpose of each. [8]

3. a) Obtain the relation between the DC output voltage and the AC line voltage(rms) and rating of converter transformer with Graetz's converter circuit [7]
   b) The AC line voltage is 330 kV with a load of 500MW and p.f =0.78 at the inverter end. Calculate the AC line voltage, current and p.f at the rectifier end with $\mu=15^0$. [7]

4. a) Explain the operation of a converter when working as an inverter, and state the necessary conditions required for inverter operation. [7]
   b) The DC voltage and current at the sending end of a rectifier station are 200 kV and 1000A respectively. The commutating reactance of the rectifier is 10 ohm and the resistance of the line is 10 ohm. Calculate the extinction angle γ, if the DC voltage is 190 kV at the terminal of the inverter. Assume the no load voltage of the inverter as 200 kV at $\gamma=0$. [7]

5. a) Describe the thyristor-controlled reactor with necessary diagrams and expressions. [5]
   b) Obtain the modelling of DC Links in HVDC system. [9]

6. a) Explain the development of DC circuit breaker. [9]
   b) What are the factors responsible for generation of characteristic and non-characteristic harmonics? How each can be reduced to a minimum? [5]

7. a) What are the different types of filters used on the AC side of an HVDC system? How are they located and arranged? [5]
   b) Describe the design of high pass filters. [9]

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