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

IV B.Tech II Semester Regular/Supplementary Examinations, June - 2022

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) Write the advantages of controllability of DC transmission systems? [2]
   b) Write the relation between source reactance and coupling factor of 12 pulse converter? [2]
   c) What is meant by constant AC voltage control? [3]
   d) List out the sources of reactive power. [2]
   e) What is meant by current extinction malfunction in the controllers? [2]
   f) Write the objective of design of AC filters? [3]

PART–B *(4x14 = 56 Marks)*

2. a) Draw the characteristics and explain the cost variation characteristics of AC and DC transmission systems. [7]
   b) Explain the reliability of HVDC transmission systems with necessary equations. [7]

3. a) Discuss in detail about the 5 modes of region of the rectifier operation of a 12 pulse converter. [7]
   b) Explain in detail about the differences between the operational features of 6 pulse and 12 pulse converters for HVDC system. [7]

4. a) Analyze the steady state equivalent circuit of a two terminal DC link by using relevant expressions. [7]
   b) Draw and explain the converter control characteristics for negative current margin. [7]

5. a) Discuss in detail about the sequential method of power flow solution with necessary equations. [7]
   b) Explain in detail about the conventional control strategies of the reactive power control in the steady state. [7]

6. a) Elaborate the short circuit in a bridge with voltage and current wave forms. [7]
   b) Discuss in detail about the differences between the voltage and current harmonics with necessary equations. [7]

7. a) Derive the expression for the inductance of a single tuned filter. [7]
   b) Explain in detail about the design aspects of high pass filter with necessary equations. [7]

Code No: **R1642022** **R16** **Set No. 2**

IV B.Tech II Semester Regular/Supplementary Examinations, June - 2022

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) List out the factors to be considered for AC and DC transmission systems. [2]
   b) Write the role of converters in HVDC transmission systems? [2]
   c) What is the function of control variable in the DC link control? [3]
   d) What is meant by a static VAr compensation system? [2]
   e) What is meant by fire through malfunction? [2]
   f) Write the need of AC filter design? [3]

PART–B *(4x14 = 56 Marks)*

2. a) Discuss in detail about the economics of power transmission by using the distance verses cost characteristics of AC and DC transmission systems. [7]
   b) Explain the choice of voltage level for long distance bulk power transmission. [7]

3. a) Write the current and voltage equations and analyze in detail about the 12 pulse converter? [7]
   b) Draw the circuit diagram and explain the operation of Graetze converter. [7]

4. a) Discuss in detail about the individual phase control of firing scheme along with the draw backs. [7]
   b) Draw and explain about the block diagram of power and auxiliary controller. [7]

5. a) Explain in detail about the solution of non linear equations in the power flows of AC/DC systems. [7]
   b) A back to back HVDC link with one bridge at each end is transmitting 120MW with V_d=122kV. If $\alpha=17^0$ and $\gamma=19^0$, find V_{dor}, V_{doi}, Q_r, Q_i by assuming $R_{cr}=R_{ci}$=15 ohms. If the DC link is controlled such that Q_i is kept at the value calculated earlier, find V_d, I_d, Q_r, α, γ for P_d=55MW. [7]

6. a) Discuss in detail about the effect of corona on the DC lines with relevant equations. [7]
   b) Elaborate various adverse effects of harmonics on the DC transmission lines. [7]

7. a) Draw the diagram and explain the operation of damped filter circuit. [7]
   b) Explain the characteristics of impedance of the single tuned filter. [7]

Code No: **R1642022** **R16** **Set No. 3**

IV B.Tech II Semester Regular/Supplementary Examinations, June - 2022

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) What is meant by synchronous interconnection? [2]
   b) List out the modes of general rectifier operation. [2]
   c) How the control of power in the DC link is achieved? [3]
   d) Write the disadvantages of forced commutation? [2]
   e) What is meant by arc through malfunction in the converters? [2]
   f) Write the relation between filter design and harmonic distortion? [3]

PART–B *(4x14 = 56 Marks)*

2. a) Explain in detail about the stability limits and voltage control of AC/DC transmission. [7]
   b) Discuss about the various new trends used to reduce cost of the converter station and improving the performance of the HVDC transmission. [7]

3. a) Elaborate the factors to be considered for the choice of the converter configuration. [7]
   b) A Graetz bridge operates with a delay angle of 17^0. The leakage reactance of the transformer is 14 ohms. The line to line AC voltage is 88kV. Find the overlap angle and DC voltage for I_d=2200amps and 4700 amps. [7]

4. a) Draw the block diagram and explain in detail about the pulse frequency control of equidistant pulse control. [7]
   b) Explain in detail about the starting and stopping criterion of DC link. [7]

5. a) Discuss in detail the basic converter model with circuit diagram. [7]
   b) Explain in detail about the alternate control strategies of reactive power control in the steady state. [7]

6. a) Explain in detail about the effect of pulse number on the harmonics. [7]
   b) Discuss about the calculation of characteristic AC harmonics with relevant equations. [7]

7. a) Draw the diagram and explain the operation of C-type high pass filter. [7]
   b) Explain the variation of impedance characteristics of damped filter with different quality factors. [7]

Code No: **R1642022** **R16** **Set No. 4**

IV B.Tech II Semester Regular/Supplementary Examinations, June - 2022

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) Write short notes and formula of energy availability? [2]
   b) Define the coupling factor of 12 pulse converter. [2]
   c) What is meant by constant DC voltage control? [3]
   d) Write the relation between forced commutation and reactive power? [2]
   e) Define the arc backs in the valves. [2]
   f) Write the draw backs of AC filters? [3]

PART–B *(4x14 = 56 Marks)*

2. a) Explain in detail about the application of DC transmission systems. [7]
   b) Draw the diagrams and explain the types of HVDC links. [7]

3. a) Elaborate the performance of two three phase converters connected in star-star model. [7]
   b) By using the circuit diagram analyze the operation of 6 pulse converter with relevant wave forms. [7]

4. a) Draw and explain in detail about the characteristics of converter controller. [7]
   b) A bipolar HVDC link operates with ±300kV, 620MW rated voltage and powers respectively at the rectifier end. The resistance of each line conductor is 18 ohms. The converter transformers have a leakage reactance of 0.17p.u on their own base values. There are two series connected converter bridges per pole. The AC bus voltage at both rectifier and inverter buses are regulated at rated voltage of 230kV. Find the ratings and turns ratios of the converter transformers at the rectifier and inverter? Also find the reactive power supplied at the rectifier and inverter stations? Assume operating values of delay angle and extinction angles as 16^0 at the inverter. [7]

5. a) Explain in detail about the solution of AC-DC power flow problem with necessary equations. [7]
   b) Discuss the operation of shunt capacitor and synchronous condenser in reactive power control of HVDC systems. [7]

6. a) What is meant by commutation failure? Explain the voltage waveforms of single commutation failure. [7]
   b) What are non characteristic harmonics? Discuss their effects on the HVDC transmission. [7]

7. a) Elaborate the design aspects of single tuned filter and write its advantages. [7]
   b) Explain the variation of impedance of a damped filter with characteristics. [7]