



R20 Regulation

Subject code: 3E7BD

# TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

## B.Tech VII Semester Regular Examinations, November 2023

### HVDC TRANSMISSION SYSTEMS (ELECTRICAL AND ELECTRONICS ENGINEERING)

Maximum Marks: 70

Date: 06.12.2023 Duration: 3 hours

- Note:
1. This question paper contains two parts A and B.
  2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
  3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
  4. Each question carries 10 marks and may have a, b, c, d as sub questions.

#### Part-A

All the following questions carry equal marks

(10x2M=20 Marks)

		Bloom
1	State the advantages in HVDC transmission.	Tx
2	What are the Modern trends in HVDC Transmission.	L1
3	Mention the ranges of firing angle for rectifier and inverter operations.	L1
4	What is the effect of commutating reactance of the converter.	L1
5	Write Controller Equations.	L2
6	What is the function of DC Converter.	L1
7	What is the material used for surge arresters for HVDC applications.	L2
8	Define Radio interference.	L1
9	What are used to filter out AC Harmonics and DC Harmonics in HVDC Transmission System.	L1
10	Define Characteristic harmonics.	L1

#### Part-B

Answer All the following questions.

(5X10M=50Marks)

11	Derive the expression for input power, output power and power factor of 12- pulse bridge converter with delay angle $\alpha$ . Assume there is no overlap. [10]	L3
OR		
12	Draw the layout of a Bi-polar HVDC substation and briefly discuss about various components present. [10]	L3
13	A. Describe Starting and stopping of DC link. [5] B. What is meant by firing angle delay and commutation delay. Draw the waveforms for voltage and current in 6-Pulse Graetz Circuit with $\alpha = 30^\circ$ , $\mu = 15^\circ$ [5]	L2 L3
OR		
14	A. Explain about different sources of reactive power to meet the reactive power requirement of Converters. [5] B. Derive the steady state equivalent circuit of HVDC converter. [5]	L3 L2

15	A. Illustrate the methods for the solution of AC-DC Power Flow. [5] B. Transformer secondary line voltage to a 3-phase bridge rectifier is 345kV. Calculate the DC voltage output with $\beta=15^\circ$ , when $\alpha=$ (a) $0^\circ$ , (b) $15^\circ$ , (c) $30^\circ$ . [5]	L3 L3
OR		
16	A. Explain the Modeling of DC Links. [5] B. The per unit values of the converters acting as a rectifier are $\overline{V}_d=0.98$ , $\overline{V}_{do}=1.0$ and $\overline{I}_d=0.9$ . Compute the delay in firing of the rectifier. [5]	L2 L2
17	Write short notes on the following: (i) Protection against over voltage in converter station [5] (ii) Over current protection in a DC line. [5]	L2 L2
OR		
18	A. Explain the operation of Smoothing reactors. [5] B. Write corona effects on DC lines. [5]	L3 L2
19	A. Explain the causes of harmonic generation in HVDC and effects on the system. [5] B. What are characteristic and non-characteristic harmonics? [5]	L3 L2
OR		
20	A. What is the Effect of Pulse number on harmonics. [5] B. Why High pass filters are provided with damping resistor? Also explain about advantages, disadvantages of High Pass Filter. [5]	L2 L3