Code No: 157BY

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, December-2023/January-2024
HVDC TRANSMISSION
(Electrical and Electronics Engineering)

Time: 3 Hours **Max.Marks:75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a)	What are the modes of region of rectifier operation of a 12-pulse converter?	[2]
b)	What are the different factors that favour DC transmission?	[3]
c)	What is the need of reactive power control in HVDC system?	[2]
d)	State the necessity of an HVDC link and list out important components of it.	[3]
e)	What is mean by P.U. system?	[2]
f)	What is the need of power flow analysis in AC/DC systems?	[3]
g)	What is meant by audible noise in HVDC system?	[2]
h)	What are the causes of overvoltage in HVDC transmission system?	[3]
i)	What is the need of filters?	[2]
j)	What are the characteristic harmonics?	[3]

PART – B

(50 Marks)

2.a) What are the different types of DC links? Discuss them with necessary diagrams.
b) With a neat schematic diagram, state the various apparatus required for HVDC station and explain the purpose of each. [5+5]

OR

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.
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 $\mu=15^0$. [5+5]

4.a) What do you understand by starting and stopping of DC link. Discuss the methods used for the same.
b) An HVDC link delivers DC power with the AC line voltage to the rectifier being 180 kV and the inverter being 165 kV. Taking $\alpha=15^0$ and $\gamma=20^0$, $R_{cI}=10$ ohm and R= 5 ohm. Calculate the DC voltage at both the ends and the current in the DC link. [5+5]

OR

5. Explain the conventional control strategies for reactive power requirements in HVDC system. [10]

6.a) Obtain the modelling of DC Links in HVDC system.

b) Describe the solution of AC-DC Power flow. [5+5]

OR

7.a) Compare simultaneous and sequential methods of power flow analysis.

b) Obtain the P.U. system for DC quantities. [5+5]

8.a) Describe the various types of converter faults. What protection is used against over current in an HVDC system?

b) Explain the protection against over currents in converter station. [6+4]

OR

9.a) Explain the development of DC circuit breaker.

b) Discuss the corona effects on DC lines. [6+4]

10.a) Identify the various sources for generation of harmonics in HVDC systems and mention the various adverse effects caused due to the presence of harmonics

b) Estimate the magnitude of 6^{th} and 12^{th} harmonic voltages in a 6-pulse converter operating at V_{d0} =200 kV with (i) $\alpha = 10^0$, $\mu = 0^0$ and (ii) $\alpha = 10^0$, $\mu = 15^0$ [6+4]

OR

11.a) What are the different types of filters used on the AC side of the HVDC system? How are they located and arranged.

b) How is a filter designed? How is cost optimization obtained in choosing L and C of a filter? Illustrate with example. [5+5]

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