



P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Eighth Semester, B.E. - Electrical and Electronics Engineering

Semester End Examination; July / August - 2022

HVDC Power Transmission

Time: 3 hrs

Max. Marks: 100

Course Outcomes

The Students will be able to:

CO1: Comparison of DC transmission with respect to AC transmission, Historical sketch, DC links, recent trends & Applications of DC transmission.

CO2: Discussion on valve characteristics, Properties and analysis of converters.

CO3: Analysis of Gratez circuit without overlap & with overlap ($<60^\circ$) (rectification & inversion).

CO4: To interpret the control strategies in reversal, manual control, Actual control characteristics, Stability & MTDC systems.

CO5: To study about the converter faults and its protection, Characteristic / Uncharacteristic harmonics, their Troubles & filters.

Note: I) PART - A is compulsory. Two marks for each question.

II) PART - B: Answer any **Two** sub questions (from a, b, c) for a Maximum of **18 marks** from each unit.

Q. No.	Questions	Marks	BLs	COs	POs
I : PART - A		10			
I a.	Mention the types of DC links.	2	L1	CO1	PO1
b.	Define pulse number.	2	L1	CO2	PO1
c.	Write the expression for direct current I_d for gratiz circuit with overlap condition.	2	L2	CO3	PO1
d.	What are MTDC systems?	2	L1	CO4	PO1
e.	Define characteristic and non- characteristic harmonics.	2	L1	CO5	PO1
II : PART - B		90			
UNIT - I		18			
1 a.	Explain the difference between AC and DC transmission system from the perspective of system planner.	9	L2	CO1	PO2
b.	i) Explain the applications of DC transmission system.	5	L2	CO1	PO2
	ii) With neat sketches, explain the different types of DC links and in DC transmission system.	4	L2	CO1	PO2
c.	With neat sketch, explain the working of typical HVDC converter station.	9	L2	CO1	PO2
UNIT - II		18			
2 a.	With neat circuit diagram, explain three phase one way rectifier and derive as expression for V_d .	9	L2	CO2	PO2
b.	Explain the analysis of a twelve pulse converter.	9	L2	CO2	PO2
c.	Explain the properties of converter circuits.	9	L2	CO2	PO2

UNIT - III**18**

- 3 a. Explain the analysis of Graetz circuit with overlap less than 60° also obtain the expression for average direct voltage in each case. 9 L2 CO3 PO2
- b. Explain V_d - I_d characteristics of inversion. 9 L2 CO3 PO2
- c. A Graetz bridge operates with a delay angle of 150° . The leakage reactance of the transformer is 10Ω . The line to line AC voltage is 85 KV. Compute the overlap angle and DC voltage for, 9 L3 CO3 PO2
- i) $I_d = 2000 \text{ A}$
- ii) $I_d = 4500 \text{ A}$

UNIT - IV**18**

- 4 a. Explain the two configurations of MTDC systems and mention its limitation of manual control. 9 L2 CO4 PO2
- b. Explain the actual characteristics of converter control and its significance of current margin and its range. 9 L2 CO4 PO2
- c. Explain the basic principles of controlling the voltage at any point on the DC line and the current and also mention the considerations influencing the selection of control characteristics. 9 L2 CO4 PO2

UNIT - V**18**

- 5 a. Explain the troubles caused by harmonics and functioning of harmonics filters. 9 L2 CO5 PO2
- b. Explain the phenomenon of telephone interference and the factors affecting it. 9 L2 CO5 PO2
- c. Explain the procedure for clearing the line faults and re-energizing the line. 9 L2 CO5 PO2

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