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Code No: 128BR

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year II Semester Examinations, July - 2023

FUNDAMENTALS OF HVDC AND FACTS DEVICES

(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 types of DC links?	[2]
b)	What are the different factors that favour DC transmission?	[3]
c)	What are the various basic firing schemes of the thyristor?	[2]
d)	What are the main objectives of control of HVDC system?	[3]
e)	What are the sources of reactive power for HVDC system?	[2]
f)	What are the assumptions made while analyzing characteristics harmonics?	[3]
g)	What are the methods of controllable VAR generation?	[2]
h)	What limits the loading capability of transmission system?	[3]
i)	Draw the basic structure diagram of UPFC.	[2]
j)	What are the objectives of series compensation?	[3]

PART – B

(50 Marks)

2.a) Explain in detail the superiority of technical performance of HVDC lines to that of EHVAC lines.

b) With a neat schematic diagram, state the various apparatus required for HVDC station and explain the purpose of each. [4+6]

OR

3.a) Obtain the equivalent circuits or rectifier and inverter configurations of twelve pulse converters.

b) Obtain the relation between the DC output voltage and the AC line voltage (rms) and rating of the converter transformer with Graetz's converter circuit. [5+5]

4.a) State the important circuit parameters which control power in an HVDC link. State the merits and demerits of control of power using each parameter.

b) An HVDC link delivers DC power with AC line voltage to the rectifier being 400 kV and that at the inverter being 395 kV. Taking $\alpha=10^0$, $\gamma=15^0$ and the DC resistance of the line as 15 ohms, determine (i) the DC voltage at both the ends, (ii) the current in the DC link and (iii) the power delivered. [5+5]

OR

5.a) State the different firing control schemes adopted for HVDC systems with neat sketches. Discuss the difference in operation of each method. Also state their merits and demerits

b) Explain the starting and stopping of DC link with necessary diagrams. [6+4]

6.a) Identify the various sources for generation of harmonics in HVDC systems? Mention the various adverse effects caused due to the presence of harmonics

b) What are the different types of filters used on the AC side of an HVDC system? How are they located and arranged. [5+5]

OR

7.a) Explain the simplified continuous time model of converter with necessary expressions.

b) Draw the flow chart for the solution of AC/DC load flow. [5+5]

8.a) Describe the flow of power in AC meshed systems with necessary diagrams.

b) Briefly discuss the basic types of FACTS controllers with necessary diagrams. [5+5]

OR

9.a) What are the objectives of shunt compensation?

b) Compare SVC and STATCOM. [5+5]

10.a) Describe the concept of series capacitive compensation.

b) Briefly discuss the basic operating control schemes for SSSC. [4+6]

OR

11. Explain the independent real and reactive power flow control with necessary diagrams. [10]

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