K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:VI
Class:TY	Program:B.Tech
Branch Code:ELE	Pattern:2022
Name of Course:Applications of Power Electronics in Power System	Course Code:ELE223014B
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 03 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.

Marks CO

Question No. 1

1a) State the following statements are true or false with justifications. (any three) (6) CO2

(i) The shunt controller (without energy source) is used to compensate reactive power only.

(ii) In monopolar HVDC line the pole voltage is negative with respect to earth.

(iii) A back-to-back HVDC links are called as asynchronous link.

(iv) In FC-TCR scheme the reactive power injected is constant with change in terminal voltage.

Question No. 2

2a) What the problems of EHV-AC system? How HVDC system can handle these problems? (6) CO1

OR

A sending end and receiving end of a transmission line is held at 1pu voltage with phase angle of 30 degree. The line reactance is 0.6pu, calculate

(i) Calculate active and reactive power transfer through transmission line.

(ii) If a series capacitor of reactance 0.3 added in the line, calculate active and reactive power transfer through transmission line.

Question No. 3

3a)	What are the applications of STATCOM? Explain any one application with control block diagram.	(8)	CO2

OR

3b)	Draw the configuration of STATCOM. Elaborate the each component used. Explain its working principle.	(8)	CO2
3c)	In three phase transmission line with 0.5pu reactance, the end voltages are maintained constant at 1pu. The phase angle difference between them is 30 degree. (i) Calculate current and power flow (active and reactive) through the transmission line (2M). (ii) Calculate the voltage injected by SSSC to increase active power flow to 1.5 times of uncompensated case. (3M) (iii) Calculate the voltage injected by SSSC to increase active power flow to 0.75 times of uncompensated case. (3M)	(8)	CO4

OR

3d)	A three phase transmission line voltage is 132kV. The STATCOM connected through 132/11kV transformer is used to compensate the reactive power requirement of the system such that it maintains the unity power factor at source side. The connected load is 150MVA at 0.8 pf leading. The interfacing reactance is 10 Ohm. Take the base values as 100MVA and 132kV. Calculate, (i) Rating of STATCOM (3M) (ii) Current supplied by the STATCOM (2M) (iii) EMF injected by the STATCOM and DC bus voltage (3M)	(8)	CO4

Question No. 4

4a)	Draw and explain the control characteristic of HVDC system.	(8)	CO2

OR

4b)	What is an SSSC? Draw its configuration and explain its working principle.	(8)	CO2
4c)	Derive the power flow control equation with SSSC in transmission system.	(8)	CO3

OR

4d)	A 12 pulse HVDC system is fed from 400KV, 50Hz AC supply the HVDC line is used to transmit the power of 1000MW through a distance of 750km. The firing angle is 30 degree. Assume the no overlap angle. Calculate (i) Average DC voltage—(2M) (ii) Average DC current—(1M) (iii) rms value of AC side current---(1M) (iv) rms value of fundamental component of AC side current—(2M) (v) rms value of dominant harmonics—(2M)	(8)	CO3

Question No. 5

5a) Explain the key points that highlight the superiority of SSSC over TCSC. (8) CO2

OR

5b) Compare the HVDC light with HVDC conventional system (minimum 6 points are expected) (8) CO2

5c) A new bipolar 2-teminal HVDC transmission system from Bishwanath (Assam) to Agra (Uttar Pradesh) HVDC systemplanned by Government of India has following specifications (8) CO4

Rated DC bus voltage	+/- 800kV
Rated Bipolar power	6000MW
Line resistance per pole per km	0.028 Ohm/km
Line length	950 km
Input AC voltage	765 kV Line to Line

Calculate

(i) DC line current per pole—(1M)

(ii) DC line power loss per pole—(1M)

(iii) DC power delivered per pole and total power at Inverter end—(2M)

(iv) DC voltage at inverter end per pole—(2M)

(v) DC voltage of rectifier 6-pulse bridge—(1M)

(vi) DC voltage of inverter 6-pulse bridge—(1M)

OR

5d) The DC voltage at the middle of a bipolar line is 1030kV DC pole to pole. The line current in each pole is 1000A and line resistance total of two poles is 50 Ohms. Calculate (8) CO4

(i) DC voltage at rectifier end—(1M)

(ii) DC voltage at inverter end—(1M)

(iii) Rectifier end per pole and bipolar power—(2M)

(iv) Inverter end per pole and bipolar power—(2M)

(v) Total transmission loss—(2M)

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