UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April/May 2018

Course: **Advance Power Transmission (HVDC, EHCAC, FACTS)** (PSEG 307)
Semester: **VIII**
Program: B Tech (Power System Engineering)
Time: 03 hrs. **Max. Marks: 100**
Instructions:

SECTION A

S. No.		Marks	CO
Q 1	List out the examples of FACTS controllers for enhancing power system control.	4	CO1
Q 2	Briefly describe the AC harmonics produced by the converters and characteristics of filters used to minimize their adverse effects.	4	CO3
Q 3	Explain in detail about energizing and de-energizing of a bridge at a converter station.	4	CO2
Q 4	Discuss the power transmission limitations and constrains which may involve power transfer between areas or regions.	4	CO4
Q 5	Discuss the importance of EHVAC lines when compared with HVDC network.	4	CO2
	SECTION B		
Q 6	Draw and explain the block diagram of system control hierarchy structure in HVDC link.	10	CO4
Q 7	Explain in detail about the problems associated with DC systems connected to weak AC systems and methods of dealing with such problems.	10	CO3
Q 8	Explain about capacitive commutated converter (CCC) which is installed in Garabi in South America. Discuss its major advantages, disadvantages and limitations of CCC.	10	CO2
Q 9 Q10	Briefly describe the DC harmonics produced by the converters and characteristics of filters used to minimize their adverse effects. **(OR)** Draw and explain the simplified analysis of CCC with necessary assumptions and commutated equivalent circuit.	10	CO4
	SECTION-C		
Q 11	Draw and explain about selective harmonic elimination techniques used in FACTS.	20	CO5
Q 12 Q13	Explain with a neat sketch about the over voltages protection system used in a converter station (HVDC) used in ROSA Thermal Power Plant **(OR)** Draw the converter unit control scheme used in high voltage DC Transmission proposed	20	CO2

	220 kV lines between Delhi – Dadri		

Name: **Enrolment No:**	UPES

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SECTION A

S. No.		Marks	CO
Q 1	Explain with a neat sketch about the various phases of power system studies for FACTS installation projects	4	CO1
Q 2	Discuss clearly about the technological developments and modern trends in HVDC.	4	CO3
Q 3	Draw the basic circuit of static VAR compensator sharing voltage characteristics and role in power factor voltage control utility.	4	CO2
Q 4	Explain about Surge Impedance Loading on a high voltage line and draw the capability curve.	4	CO4
Q 5	Explain in detail about non – characteristic harmonics and effects due to harmonics in HVDC lines.	4	CO2
	SECTION B		
Q 6	Draw and Explain the single line diagram of a voltage source converter based HVAC converter station.	10	CO4
Q 7	Explain the need of filters on the DC side with HVDC voltage source converter schemes.	10	CO3
Q 8	Mention the various sources of harmonic generation in HVDC systems and suggest methods to eliminate them.	10	CO2
Q 9	Explain with the help of neat diagrams, about the FACTS controller circuits and system performance characteristics to confirm the network load flow conditions and the operations are within the bench mark limitations.	5	CO4
	(OR)		
Q10	Explain the causes for over voltages in DC systems. Discuss the various insulators used on AC and DC power lines and state the effects with relevant comparison.	5	
	SECTION-C		
Q 11	State the basic parameters to be considered in the design of ground electrodes. Give a neat sketch of an electrode trench for the land electrode in grounding of HVDC lines.	20	CO5

Q 12 Q13	An HVDC link delivers DC power at 500kV at the inverter end with constant current controller at rectifier end set at 1000A. The equivalent resistance of the rectifier and inverter station are 15Ω and 18Ω respectively. The DC resistance of the line is 20Ω. If the AC voltage at the rectifier is 400kV, find the percentage of the tap changer required to maintain the current constant in the DC link without gate control. **(OR)** Explain in detail about the solution to stability problems associated in FACTS and HVDC transmission lines.	**20**	**CO2**