Roll No: ----------

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, APR 2017

Program/course: B Tech (Power System Engineering) **Semester – VIII**
Subject: Advanced Power Transmission **Max. Marks : 100**
Code : PSEG 307 **Duration : 3 Hrs**
No. of page/s: 02

Section – A

Answer All Questions **5 x 4 = 20 Marks**

1. Briefly describe the AC harmonics produced by the converters and characteristics of filters used to minimize their adverse effects.

2. Explain in detail about non – characteristic harmonics and effects due to harmonics in HVDC lines.
3. List out the examples of FACTS controllers for enhancing power system control.

4. Explain in detail about energizing and de-energizing of a bridge at a converter station.

5. Draw the basic circuit of static VAR compensator sharing voltage characteristics and role in power factor voltage control utility.

Section – B

Answer All Questions **4 x 10 = 40 Marks**

6. Draw a neat schematic diagram of homopolar HVDC system and explain the main components in the circuit.
7. Draw the characteristics of 6 pulse converter used in HVDC line at Delhi to Dadri HVDC line.
8. Explain in detail about harmonic interactions and harmonic instability in high voltage transmission lines
9. Discuss in detail the power transmission limitations and constrains which may involve power transfer between areas or regions.

OR

10. Draw and Explain the single line diagram of a voltage source converter based HVAC

converter station based in Sasaram 220 kV line designed by GEC Alsthom.

Section – C

Answer All Questions **2 x 20 = 40 Marks**

11 a) Discuss the operating problems and major difficulties in the adoption of HVDC technology by system planners.

b) Draw and explain about selective harmonic elimination techniques used in FACTS.

12. a) A back to back HVDC link with one bridge at each end is transmitting 100MW with

$\mathbf{V_d}$ = 100kV. If $\alpha = 15^0$; $\gamma = 18^0$. Find the $\mathbf{V_{dor}}$**;** $\mathbf{V_{doi}}$**;** $\mathbf{Q_r}$ **&** $\mathbf{Q_i}$. Assume $\mathbf{R_{cr} = R_{ci} = 12\ \Omega}$

b) If the DC link is controlled such that Q_i is kept at the value calculated earlier, find $\mathbf{V_d}$**,** $\mathbf{I_d}$**,** $\mathbf{Q_r}$**,** $\boldsymbol{\alpha}$ **and** $\boldsymbol{\gamma}$ **for** $\mathbf{P_d}$ = 50MW**.**

OR

13. Draw and Explain the single line diagram of a voltage source converter based HVAC converter station based in Sasaram 220 kV line designed by GEC Alsthom.

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Section – A

Answer All Questions **5 x 4 = 20 Marks**

1. Explain with a neat sketch about the various phases of power system studies for FACTS installation projects.
2. Discuss clearly about the technological developments and modern trends in HVDC.
3. Explain the power frequency overvoltage factors required in 220kV transmission line and draw the characteristics of power frequency over voltage characteristics.
4. Explain about Surge Impedance Loading on a high voltage line and draw the capability curve.
5. Draw and explain about thyristor controlled series compensator used in FACTS for control operation in power sector.

Section – B

Answer All Questions **4 x 10 = 40 Marks**

6. Briefly describe the DC harmonics produced by the converters and characteristics of filters used to minimize their adverse effects.
7. Draw and explain the block diagram of system control hierarchy structure in HVDC link.
8. Explain with a neat sketch about the various phases of power system studies for FACTS installation projects.
9. Explain in detail about the problems associated with DC systems connected to weak AC systems and methods of dealing with such problems.

OR

10 a) Explain about capacitive commutated converter (CCC) which is installed in Garabi in South America. Discuss its major advantages, disadvantages and limitations of CCC.

b) Draw and explain the simplified analysis of CCC with necessary assumptions and commutated equivalent circuit.

Section – C

Answer All Questions **2 x 20 = 40 Marks**

11. Explain with a neat sketch about the over voltages protection system used in a converter station (HVDC) used in Adani Thermal Power Plant

12. A double tuned AC filter at Rihad – Delhi HVDC converter station has the following parameters. **C_1 = 0.77 µF; L_1 = 94.93mH; C_3 = 31.69µF; L_2 = 2.29mH; f = 50Hz; V_1 = 400kV;**

Compute a) **ω_1 and** ω_2 b) Reactive power **Q_r**

OR

13. Draw and explain about selective harmonic elimination techniques used in FACTS.