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Total Number of Pages: 01

M.TECH
EEPE201

Second Semester Examination 2013
HVDC TRANSMISSION AND FACTS (EEPE201)

Max marks: 70

Time: 3 Hours

Answer Question No.1 which is compulsory and any five from the rest.

The figures in the right hand margin indicate marks.

- 1.a) What are the advantages and disadvantages of monopolar HVDC links over other types of links? 2×10
- b) Why multiterminal DC system needed? What are the different types of MTDC system used?
- c) Find the best values of q, s and r for a 12-pulse converter configuration. Justify your answer. (where q = no of valves in a commutation group, r = valve groups in parallel, s = valve groups in series)
- d) Draw a simple model of Thyristor –controlled Series Capacitor (TCSC) and explain its working briefly.
- e) What are the equipments that supply reactive power on HVDC converter station?
- f) How can justify that HVDC transmission is cheaper than HVAC transmission?
- g) Draw the circuit diagram of SSSC (static synchronous series compensator). Explain its operation
- h) Distinguish between delay angle (α) and extinction angle (γ) of an HVDC converter. State the necessary condition required for converter when working as an inverter
- i) A 6 pulse bridge connected converter is fed from 238kV/110kV transformer which is connected with 3- Φ , 238kV, 50Hz supply. Calculate the direct voltage output when commutation angle (overlap angle) is 20 degree and delay angle (a) 50° (b) 135°
- j) A 6-pulse bridge inverter is fed from 500kV dc voltage. Find the ac voltage output of the inverter if the advance angle is 20° and extinction angle is 10°
- 2.a) Draw the neat sketch of STATCOM. Explain its working. 5×2
- b) How can 'DC link control' be explained? Describe the phenomenon of constant Extinction Angle Control.
- 3.a) Find the effective commutation resistance of a 6-pulse rectifier, which is fed from 400kV, 3- Φ ac voltage, when the dc current in HVDC link is 2 kA and the rectifier dc voltage is 500kV at firing angle of 30° . 3×1
- b) Explain in details the operation of DC breakers with current & voltage wave forms. Write the applications of DC breakers 7×1
- 4.a) Explain briefly about Voltage-Dependent Current Order Limit (VDCOL) & draw the control characteristics. 5×2
- b) What do you understand by current margin between two stations in an HVDC link? How it is assigned to the station? Why is it advantageous to operate the inverter as constant voltage under normal conditions?
- 5.a) Justify that FACTS technology open up new opportunities for controlling power and enhancing the usable capacity of present. What are the different types of FACTS devices? 5×2
- b) What are the various firing schemes employed for thyristor valves in HVDC transmission? Explain equidistant pulse control scheme.
- 6 A monopolar HVDC link has one bridge at each terminal. The parameter of the link are: $\alpha_{min}=5^\circ$, $\gamma_{min}=18^\circ$, $R_d=5\Omega$, $R_{cr}=10\Omega$, $R_{ci}=12\Omega$, $V_{dor}=115KV$, I_{ref} at the rectifier=1KA, I_{ref} at the inverter =900A 10×1
(A) If $V_{doi}=117.5KV$, Calculate I_d , α , γ , P_i and Q_i (B) Repeat (A) if $V_{doi}=120KV$
- 7.(a) Draw the neat sketch of UPFC system. Explain its working 5×2
- (b) With a neat schematic diagram, state the various apparatus required for BIPOLAR HVDC station and explain the purpose of each
- 8 Write short notes on any two 5×2
(a) GTO Thyristor Controlled Series Capacitor
(b) Greutz circuits with overlap
(c) SVC (Static VAr Compensator)