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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Eighth Semester, B.E. - Electrical and Electronics Engineering

Semester End Examination; June - 2017

HVDC Power Transmission

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Compare HVAC and HVDC transmission based on the economics of power transmission. 6

b. Draw and explain the different types of HVDC links. 6

c. Illustrate the choice of voltage level for a fixed power transfer for both point to point and back to back HVDC systems. 8

2 a. Compare HVAC and HVDC transmission based on voltage control and problems of AC interconnection. 6

b. Draw and explain the different configuration for asynchronous interconnection of HVDC systems. 6

c. Sketch schematic diagram of a typical HVDC converter station and briefly explain. 8

UNIT - II

3 a. What is Graetz circuit? Comment on the choice of best configuration. 6

b. Perform the analysis of Graetz circuit neglecting the overlap condition, derive the Average dc output voltage with necessary voltage waveforms at $\alpha = 0°$ and 45°. 14

4 a. Discuss the turn-on and turn-off switching characteristics of Thyristor. 10

b. Draw the circuit and explain how two 3 ϕ one way circuit combined to form a six pulse circuit? 10

UNIT - III

5 a. Derive and explain the following with reference to the converter performance :

(i) Valve Utilization Factor-VUF (ii) Transformer Utilization Factor-(TUF). 8

b. Compute VUF for the following converter configuration :

(i) $q = 2$, $r = 1$, $s = 3$ (ii) $q = 3$, $r = 2$, $s = 1$ 6

Select the best configuration and justify.

c. What is overlap angle? Draw the equivalent circuit of a bridge converter. 6

6 a. Analyse the Gratez circuit with overlap condition. Obtain the expression of direct current I_d. 10

b. A 3ϕ, 6 pulse rectifier is fed from a transformer with nominal rating of 220 kV/110 kV

(i) Determine the DC output voltage when $\alpha = 20°$ and u = 18°

(ii) If the direct current delivered by the rectifier is 2000 A, calculate the effective commutating reactance, power factor and fundamental component of AC current. 10

Contd….2

UNIT - IV

7 a. Outline the desired features of HVDC power control. 8

b. With the help of schematic diagram, explain constant-current regulator for the control of HVDC converter. 12

8 a. With the help of equivalent circuit of dc transmission in steady state condition, explain the basic means of HVDC power control. 8

b. Contrast the constant current and constant voltage method of HVDC power control. 6

c. Discuss the role of Tap-changer control in HVDC power control. 6

UNIT - V

9 a. Discuss the procedure of control for fault clearing and reenergization of line. 7

b. Explain the causes and consequences of uncharacteristic harmonics. 6

c. What are the means of reducing harmonics? Briefly explain. 7

10 a. Discuss the following basic types-converter faults :

(i) Arc through (ii) Misfire (iii) Commutation failure. 10

b. Outline the important functions of smoothing reactor. 3

c. Find the inductance of the dc reactor required to prevent consequent commutation failures in the inverter described below :

Number of bridges per pole	: 2
Rated voltage per bridge	: 200 kV
Rated current (I_{dn})	: 1.86 kA
I_{s2}	: 10.0 kA
Frequency	: 60 Hz
Normal extinction angle γ_n	: 16°
Min extinction angle γ_m	: 8°

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