**R13**

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
### B. Tech IV Year II Semester Examinations, May - 2017
### FUNDAMENTALS OF HVDC AND FACTS DEVICES
### (Electrical and Electronics Engineering)

Time: 3 hours          Max. Marks: 75

**Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

## PART - A
(25 Marks)

1.a) What are the demerits of HVDC transmission system? [2]

  b) What are the applications of DC transmission system? [3]

  c) Draw the converters control characteristics. [2]

  d) What is meant by firing angle control? [3]

  e) What is the need of filters? [2]

  f) Write the Controller Equations. [3]

  g) What are the basic types of FACTS controller? [2]

  h) What are the objectives of Shunt Compensation? [3]

  i) What is the concept of series capacitive compensation? [2]

  j) Draw the schematic diagram for Unified Power Flow Controller. [3]

## PART - B
(50 Marks)

2.a) Compare A.C. and D.C. transmission system based on economic aspects and technical performance and reliability.

  b) With neat sketches explain the different kinds of D.C. links available and list out its merits and demerits. [5+5]

**OR**

3.a) Describe modern trends in DC transmission.

  b) Draw the circuit diagram voltage and current waveform of a three-phase, 6-pulse uncontrolled bridge rectifier and derive the expression for (i) Average DC voltage and (ii) total VA rating of valves and transformer. [5+5]

4.a) Discuss equidistant pulse firing angle control scheme with its relative merits and demerits

  b) A 6-pulse bridge connected inverter is fed from 238/110 kV transformer which is connected with 3-$\phi$, 238 kV, 50Hz supply. Calculate the direct voltage output when the commutation angle is $20^0$ and delay angle $\alpha$ is i) $30^0$, ii) $90^0$ and iii) $150^0$. Comment on the results. [5+5]

**OR**

5.a) Explain the starting and stopping of DC link

  b) The AC side line voltage of a 3-$\phi$ bridge type inverter is 160kV with an extinction angle of $20^0$ and an overlap angle of $20^0$. Calculate the DC voltage. What should be the new extinction angle if the DC voltage at inverter and drop to 175 kV with the overlap angle and the AC line voltage remaining unaltered? [5+5]

6.a) Classify the solution methodology for AC-DC load flows and explain.
  b) Discuss in detail, the concept of reactive power requirement in HVDC converters. [5+5]

**OR**

7.a) Explain the static VAR systems with neat diagrams.
  b) Briefly discuss what the different harmonic instability problems are          [5+5]

8.  Explain the power flow control in an AC transmission system with necessary diagrams.
                                                                            [10]

**OR**

9.a) Define the various types of FACTS controllers.
  b) Describe how to prevent voltage instability using static shunt compensation.   [5+5]

10. Describe how do you improvement of transient stability and power oscillation damping using static series compensation.          [10]

**OR**

11. Discuss the independent real and reactive power flow control of UPFC with necessary diagrams.                                                    [10]

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