Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (EEE)/SEM-7/EEE-704A/2012-13

2012

HIGH VOLTAGE D.C. TRANSMISSION

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : 10 × 1 = 10

   i) Smoothing reactors are used in HVDC system because

      a) prevent commutation failure

      b) decrease harmonics

      c) preventing current from being discontinuous

      d) all of these.

   ii) Among the following which one is not used in a HVDC system ?

      a) Thyristor b) Diode

      c) Circuit breaker d) None of these.

   iii) HVDC system is economical HVAC system for a length

      a) 50 km b) 300 km

      c) 400 km d) 500 km.

iv) The mostly used HVDC link is

a) Bipolar b) Homopolar

c) Tripolar d) Monopolar.

v) Arc-back phenomenon is associated with

a) Thyristor valve b) MOSFET valve

c) Mercury-arc valve d) GTO valve.

vi) A single thyristor valve is economical than other valves for voltage more than

a) 1·1 kV b) 6·6 kV

c) 10 kV d) 3·3 kV.

vii) Among the followings which is not responsible for commutation failure ?

a) Late ignition b) Low AC voltage

c) High direct current d) All of these.

viii) Among the followings which is the basis of selection of control in a HVDC system ?

a) Maintaining high power factor at the transmission end only

b) Maintaining low power factor at the transmission end only

c) Both (a) & (b)

d) None of these.

ix) Current is the difference of

a) rectifier current order and *d.c.* current

b) inverter current order and *d.c.* current

c) gate current and *d.c.* current

d) rectifier current and inverter current.

x) Maximum short-time current is limited to

a) 10 times than normal b) 0·5 times than normal

c) 1·2 times than normal d) 4 times than normal.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. What are the different types of HVDC links ? Explain briefly.

3. What do you understand by commutation failure ? Explain briefly.

4. Explain the ideal control characteristics of a HVDC system.

5. A three-phase 12-pulse rectifier is fed from a transformer with nominal voltage rating of 220/110 kV.

   If the primary voltage is 230 kV and the effective turns ratio T is 0·48, determine the *d.c.* output voltage when the firing angle delay angle is 20 degree and the commutation angle is 18 degree.

6. Draw the valve switching sequences with period of conduction of each valve in thyristor based 6-pulse converter with no firing angle delay.

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) With a neat sketch, explain the operation of *d.c.* circuit breaker.

   b) List the limitations. 10 + 5

8. a) What are the different components of a HVDC sub-station ? Explain briefly.

   b) Derive the current equation of the incoming valve in a 6-pulse bridge converter. 8 + 7

9. a) What are the different harmonics available in a HVDC system ?

   b) What do you mean by effective short circuit ratio ? Explain briefly. 7 + 8

10. a) A three-phase 12-pulse rectifier is fed from a transformer with nominal voltage rating of 220/110 kV. If the direct current delivered by the rectifier is 2000 A, calculate the effective commutating reactance, RMS fundamental component of alternating current, power factor and reactive power at the transformer primary side.

    b) What are the advantages and disadvantages of forced commutation ? 9 + 6

11. Write short notes on any *three* of the following : 3 × 5

    a) Bi-polar HVDC link

    b) Current source converter

    c) AC-DC interface at the HT bus

    d) DC harmonics

    e) Arc-Back

    f) Capacitor Commutated converters

    g) Mercury-arc rectifier.