Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(EE-NEW)/SEM-7/EE-704-A/2009-10

2009

HIGH VOLTAGE ENGINEERING

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 any *ten* of the following : 10 × 1 = 10

i) The voltage regulator of a testing transformer testing an insulator is

a) positive b) negative

c) none of these d) zero.

ii) Series resonant circuit operates at

a) unity p.f. b) leading p.f.

c) lagging p.f. d) zero p.f.

iii) Wave front of an impulse voltage wave is

a) 1·2/50 μs

b) 12/500 μs

c) 0·8/30 μs.

iv) The material used in gapless surge arrestor used in *h.v.* power system is
   a) graphite
   b) silicon carbide
   c) zinc oxide.

v) Corona discharge is
   a) partial discharge
   b) disruptive discharge
   c) none of these.

vi) Most of the lightning strokes are of
   a) negative polarity b) positeve polarity
   c) neutral polarity d) none of these.

vii) High voltage cable insulator material for 400 kV cable is
   a) XLPE b) paper
   c) glass d) none of these.

viii) The peak value of lightning currernt is of the order of
   a) 10000 A b) 10^6 A
   c) 100 A d) none of these.

ix) Breakdown of commercial insulating oil is affected by
   a) solid particles
   b) material of the vessel containing the liquid
   c) colour of the ligquid
   d) none of these.

x) The principal device to protect a sub-station equipment from lightning over voltages is
   a) Lightning Arretor b) Lightning Conductor
   c) Counter poise d) none of these.

xi) Breakdown is permanent in
   a) gases b) solids
   c) liquids d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. 'Corona inaption voltage in a non-uniform field is lesser with negative polarity compared to positive polarity voltage application." Justify the statement.

3. Explain with circuit diagram the working principle of a peak voltmeter to measure peak value of a high a.c. voltage in conjunction with a capacitor divider.

4. What is a partial discharge ? How is it developed under a.c. voltage application in a solid dielectric. Draw the analogue circuit and explain the nature of the voltage across the void in the solid.

5. What are the advantages of a series resonant circuit over a testing transformer, testing a cable.

6. Explain how cloud is electrified.

GROUP – C

(Long Answer Type Questions)

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

7. a) What are the different mechanisms involved in the breakdown of a solid dielectric.

   b) Explain :

      i) intrinsic breakdown

      ii) electrothermal breakdown.

   c) Derive the critical electric stress expression for electro-mechanical breakdown. 2 + 8 + 5

8. a) Explain with neat diagram the operation of a 3 stage testing transformer to produce 900 kV.

   b) Show that for a testing transformer the installed kVA is greater than the output kVA. 10 + 5

9. What are the high voltage tests conduced on a distribution transformer ? Explain power frequency separate source, withstand test and induced over voltage test. State the utility of conducting these tests. Draw the connection diagrams.

   2 + 3 + 3 + 3 + 4

10. a) Explain with neat diagram, the principle of operation of an electrostatic voltmeter establishing the necessary theory.

    b) What types of voltages can be measured by it ?

    c) Explain why a capacitance voltage transformer has to be tuned to measure high a.c. voltage. Explain with phasor diagrams. 8 + 2 + 5

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

    a) Triggering of an impulse generator using trigatron gap.

    b) i) Limitations of Town send Theory

       ii) Statistical time delay

       iii) Formative time delay.

    c) Gapless arrestor and its advantages over gapped arrestor.

    d) Location of a lightning arrestor from a transformer in a sub-station.

    e) Generating voltmeter for the measurement of high d.c. voltage.