Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(EE)(SEPARATE SUPPLE)/SEM-8/EE-801A/2011

2011

ADVANCED 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 : $10 \times 1 = 10$

   i) The breakdown voltage of air is

   a) 3 kV/cm b) 30 kV/cm

   c) 3 kV/mm d) 3 kV (peak) / mm.

   ii) The voltage drop for a certain Cockcroft and Walton circuit is small if

   a) The load current is small

   b) The frequency of the supply is small

   c) The capacitance of each stage is small

   d) All of these.

   iii) Partial discharge can be detected by

   a) listening to hissing sound

   b) a high tan δ

   c) optical method

   d) all of these.

iv) The mechanism responsible for dielectric loss in a dielectric are
   a) Conduction b) Polarization
   c) Ionization d) All of these.

v) Liquids with solid impurities
   a) has higher dielectric strength
   b) of larger size has higher dielectric strength
   c) has lower dielectric strength as compared to pure liquids
   d) none of these.

vi) FEM stands for
   a) Fast Element Method
   b) Field Estimation Method
   c) Finite Element Method
   d) Fast Estimation Method.

vii) In order to reduce ripples and/or voltage drop, it is more economical to use
   a) high frequency and high capacitance
   b) high frequency and low capacitance
   c) low frequency and low capacitance
   d) low frequency and high capacitance.

viii) The frequency spectrum of PD pulse current contains complete information concerning
   a) the measurable charge in low frequency range
   b) apparent charge in the low frequency range
   c) apparent charge in the high frequency range
   d) none of these.

ix) Basic fundamental princple of generating high impulse voltage is that
   a) Serially charging of capacitors and serially discharging
   b) Serially charging of capacitors and parallel discharging
   c) Parallel charging of capacitors and serially discharging
   d) Parallel charging of capacitors and parallel discharging.

x) Standard impulse testing of a power transformer requires

a) two applications of chopped wave followed by one application of full wave

b) one application of chopped wave followed by one application of full wave

c) one application of chopped wave followed by two applications of full wave

d) none of these.

xi) The process of ionization is brought about by

a) positive ions only b) photons only

c) metastables only d) all of these.

xii) Penning effect explains

a) increase in dielectric strength of all mixture of gases

b) decrease in dielectric strength of many mixtures of gases

c) increase in dielectric strength of many mixture of gases

d) none of the these.

GROUP – B

(Short Answer Type Questions)

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

2. Explain with relevant diagram the method of measuring resistivity of an insulating material.
3. Explain the basic principle of generating DC high voltage with relevant diagram.
4. Explain the different testing procedure of circuit breakers.
5. Explain Townsend's first and second ionization coefficient in the context of breakdown of gases.
6. (i) What do you understand by time lags for breakdown ? 2

(ii) Discuss Streamer theory of breakdown in gases. 3

GROUP – C

(Long Answer Type Questions)

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

7. Explain the concept of real charge and apparent charge and hence establish a relation between them. 6 + 9

8. (i) Explain the procedure of measuring impulse voltage using potential dividers.

   (ii) A resistance divider of 1400 kV (impulse) has a high voltage arm of 16 kilo-ohms and a low voltage arm consisting 16 members of 250 ohms, 2 watt resistors in *n* parallel. The divider is connected to a CRO through a cable of surge impedance 75 ohms and is terminated at the other end through a 75 ohm resistor. Calculate the exact divider ratio. 9 + 6

9. Explain Cockcroft - Walton voltage multiplier circuit with the relevant diagram and hence derive the optimum stage and maximum output voltage of the generator.

10. Derive the Poisson's equation and hence Laplace's equation. Discuss the different numerical methods of high voltage field estimation and compare them. 5 + 10

11. Define impulse wave. Explain all detailed analysis of single stage impulse generator and hence represent a multistage impulse generator with it. 3 + 12

12. Write short notes on any *three* of the following : 3 × 5 = 15

    (i) Capacitive voltage transformer

    (ii) Electrolytic tank method of field computation

    (iii) Measurement of dielectric constant and loss angle

    (iv) Measurement of PD pulse

    (v) Voltage distribution in a transformer under impulse voltage.