Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech/EE/SEM-8/EE-801A/2013

2013

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 process of ionisation is brought about by

      a) positive ions only

      b) photons only

      c) metastables only

      d) all of these.

   ii) The electric field in a gas bubble which is immersed in a liquid of permittivity $\in$, is liquid

      a) higher than that of the field in the liquid

      b) lower than that of the field in the liquid

      c) same as that in the liquid

      d) none of these.

iii) If E_r is the radial field due to space change and E_0 the externally applied field, the transformation of avalanche into streamer takes place when

a) $E_r < E_0$ b) $E_r > E_0$

c) $E_r \approx E_0$ d) both (a) and (c).

iv) According to Paschen's law, the break-down voltage of a uniform field gap is a function of

a) product of gas pressure and gap length

b) product of gas pressure and temperature

c) product of electrode area and length

d) product of gas pressure and electrode area.

v) A simple partial discharge detector circuit consists of a power unit and a

a) coupling capacitor and test capacitor

b) coupling capacitor, test capacitor, measuring impedance and detector

c) test capacitor, measuring impedance and a detector.

d) test capacitor, calibrating unit and detector.

vi) In impulse testing transformers fault location is usually done by

a) neutral/tank current oscillogram

b) scanning method

c) chopped wave oscillogram

d) observing noise or smoke.

vii) For obtaining the rating of circuit breakers

a) mechanical test is done

b) thermal test is done

c) short circuit test is done

d) dielectric test is done.

viii) A generating voltmeter

a) generates voltage

b) generates current

c) is a variable capacitor device

d) both (b) and (c).

ix) In a Cockroft Walton circuit, input voltage is 100 kV, load current 100 mA, supply frequency 100 Hz each capacitor 10 nF. The optimum number of stages for maximum output voltage is

a) 1 b) 10

c) 15 d) 35.

x) Wagner's earth is used with Schering bridge for

a) grounding

b) diverting high current through the bridge when specimen fouls

c) suppressing spikes and overvoltages

d) eliminating stray capacitance and coupling.

xi) In power system surge voltage originates due to

a) lightning

b) switching operations

c) faults

d) any of these.

xii) In case of impulse thermal breakdown of solid insulating materials, the critical electric field is

a) proportional to critical absolute temperature

b) proportional to square of critical absolute temperature

c) proportional to square of critical pressure

d) proportional to square root of critical absolute temperature.

GROUP – B

(Short Answer Type Questions)

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

2. Starting with Laplace's equation in two dimension, explain the finite difference method for evaluation of field distribution.

3. Define Tounsend's first and second ionisation co-efficients.

4. Show that the distribution of voltage along the transformer winding is nonlinear for application with impulse voltage.

5. Describe the functions of protective resistance, damping resistance and discharge resistance in the basic single impulse generator circuit.

6. Describe the method of dielectric test of circuit breakers.

GROUP – C

(Long Answer Type Questions)

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

7. a) Explain the high voltage Schering bridge for measurement of capacitance and dissipation factor of insulators and bushings.

   b) Explain the modification to be made to the Schering bridge for high dissipation factor test objects.

   c) A 33 kV, 50 Hz high voltage Schering bridge is used to test a sample of insulation. The various arms have the following parameters on balance : The standard capacitance 600 PF, the resistive branch 800 ohm and branch with parallel combination of resistance and capacitance has values 160 Ω and 0·15 μF respectively. Determine the value of the capacitance of this sample, its parallel equivalent loss resistance, p.f. and power loss under these test conditions. 6 + 3 + 6

8. a) What is a 'partial discharge' in a solid dielectric ?

   b) How do the internal discharge phenomena lead to breakdown in solid dielectric ?

   c) What is the effect of the frequency of supply voltage on the intensity of partial discharge ? 5 + 5 + 5

9. a) Draw a typical impulse current generator circuit. Explain its operation and application.

   b) Discuss a method to measure impulse voltage. 9 + 6

10. a) What is "conditioning of electrodes" ? How does it affect breakdown in vacuum ?

    b) Explain the process of breakdown in electronegative gases. 6 + 9

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

    a) Electrolytic tank method of electric field computation

    b) Triggering techniques adopted in multistage impulse generator

    c) Tests on lightning arrester

    d) DC high voltage generation.