Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(EE-N)/SUPPLE/SEM-8/EE-801A/2010

2010

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 × 1 = 10

i) Sphere gap is used for measurement of

a) a.c. voltage only

b) d.c. voltage only

c) impulse voltage of any shape

d) (a) and (b).

ii) A generating voltmeter

a) generates voltage

b) generates current

c) is a variable capacitor device

d) (b) and (c).

iii) In Cockroft-Walton circuit, input voltage is 100 kV, load current is 100 mA, supply frequency is 100 Hz, each capacitor is 10nF. The optimum no. of stages for maximum output voltage is

a) 1 b) 10

c) 15 d) 35.

iv) The short-circuit impedance of a 3-stage cascaded transformer as compared to a single unit transformer is

a) 3 to 4 times b) 8 to 9 times

c) 15 to 16 times d) 352 to 452 times.

v) The electric field in a gas bubble which is immersed in a liquid is

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.

vi) The Townsend's criterion for threshold sparking is given as

a) $e^{\alpha d} = 1$ b) $\gamma e^{\alpha d} = 1$

c) $e^{\alpha d} / \gamma = 1$ d) $\gamma e^{\alpha d} = 2$.

vii) Trichel pulses are noticed in a point plane gap in air when

a) point is positive

b) point is negative

c) these pulses are seen in plane-sphere gap

d) these pulses are seen in point-sphere gap.

viii) Liquids with solid impurities

a) have higher dielectric strength

b) of large size have higher dielectric strength

c) have lower dielectric strength as compared to pure liquids

d) none of these.

ix) If a single stage system using resonance test voltage is required, it is better to use

a) series resonant circuit

b) parallel resonant circuit

c) series-parallel resonant circuit

d) any one of these.

x) The impulse ratio for any particular object

a) is a constant

b) depends upon shape of wave

c) depends upon polarity of the impulse wave

d) (b) and (c)

xi) In order that impulse circuit operates consistently, it is essential that

a) the first gap is slightly less than the second and so on

b) the axes of the gaps should be in the same vertical plane

c) (a) and (b)

d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. What are field intensity coefficients when referred to Charge Simulation Method ?

3. Discuss the advantages and limitations of Charge Simulation Method.

4. What is the difference between Statistical and Formative time lags ?

5. Explain the effect of polarity of conductor on corona inception voltage and breakdown voltage.

6. An absolute electrostatic voltmeter has a movable circular plate of 8 cm in diameter. If the difference between the plates during a measurement is 4 mm, determine the potential difference when the force of attraction is 0.2 gm-wt.

GROUP – C

(Long Answer Type Questions)

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

7. a) Compare the performances of half-wave rectifier and voltage doubler circuits for generation of high d.c. voltages.

   b) Explain with neat sketches, Cockroft-Walton voltage multiplier circuit.

   c) Compare the performance of series and parallel resonant circuits for generation of high a.c. voltages.

   5 + 6 + 4

8. a) Draw Chubb-Fortescue circuit for measurement of peak value of a.c. voltages.

   b) Discuss the advantages of the above circuit over other methods.

   c) A peak reading voltmeter is required to measure voltage upto 150 kV. The peak voltmeter uses an RC circuit, a micrometer and capacitance potential divider. The potential divider has a ratio of 1200 : 1 and micrometer can read upto 10 μA.

   Determine the value of R and C, if the time constant of RC circuit is 8 secs. 5 + 5 + 5

9. a) What are the requirements of a sphere gap for measurement of high voltages ?

   b) Discuss the advantages of sphere gap for measurements.

   c) Discuss the effects of

      (i) nearly earthed objects

      (ii) humidity and

      (iii) dust particles on the measurements using sphere gap.

   d) What is corona discharge ? 3 + 4 + 6 + 2

10. a) Define the following terms :

      (i) Impulse voltage

      (ii) Impulse flashover voltage

      (iii) Impulse puncture voltage

      (iv) Impulse ratio for puncture.

   b) Describe the principle of operation of multistage Marx's surge generator. 8 + 7

11. a) What are partial discharges ?

b) Differentiate between internal and external partial discharges.

c) What is apparent charge in relation to partial discharges.

d) Show that the calculation of apparent charge as a measure of partial discharges even though is more realistic than calculation of change in voltage across the electrode, has limited application for partial discharge measurement. 3 + 3 + 3 + 6

12. a) Derive the expression of Paschen's law.

b) How do you account for the minimum voltage for breakdown in the Paschen's curve ?

c) What are 'Treeing' and 'Tracking' ? 5 + 6 + 4