Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B. TECH (EE-NEW)/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) Minimum sparking potential of air is about
   a) 100 kV b) 4·4 kV
   c) 40 V d) 325 V.

ii) Thermal classification of insulating materials is done for
   a) gases b) liquid
   c) solids d) none of these.

iii) The material used in gap has surge arrester is
   a) silicon carbide b) aluminium oxide
   c) zinc oxide d) ferric oxide.

iv) Breakdown is permanent in
   a) gases b) liquids
   c) solids d) all of these.

v) A numerical method to determine electric field in a multi-conductor geometry is

a) electrolytic tank method

b) resistance analog method

c) finite element method

d) Laplace equation method

vi) The most suitable numerical method to solve electrostatic field problems is

a) Laplace's equation

b) charge simulation method

c) finite difference method

d) resistance analog method

vii) Finite Element method can be used only with

a) fields which are bounded

b) fields which are unbounded

c) fields which are both bounded and unbounded

d) when high accuracy is not required

viii) According to Townsend current growth process the current (I) in a uniform electric field gap is

a) $I_o e^{(-\alpha d)}$ b) $I_o e^{(+\alpha d)}$

c) $I_o e^{(\square d)}$ d) $I_o e^{(-\square d)}$

ix) Paschen's law states that

a) breakdown voltage is a function of electric field

b) breakdown voltage is a function of pd

c) α and $\square$ depends on E/p

d) electronegative gases have high breakdown voltage

x) Transformer oils is

a) Askeral b) Silicone oil

c) Polyester d) Mineral oil

xi) Long-term deterioration and breakdown occurs in solid dielectrics due to

a) thermal phenomenon

b) surface discharges

c) internal discharges

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

$3 \times 5 = 15$

2. Explain the different testing procedures of circuit breakers.

3. What are the different time lags involved in the development of breakdown process ?

4. What is meant by Electric stress? Explain the different stress controlling techniques.

5. What is partial discharge ? How does partial discharge develop in the gas inclusions of a solid dielectric ? Sketch the current and voltage across the inclusions under the application of a.c. voltage.

6. What are the characteristics of an impulse wave? Determine the characteristics as per Indian standard.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Explain the concept of real charge and apparent charge and hence establish a relation between them.
   b) Explain straight detection method of measurement of partial discharge in a solid.
8. How does a transformer winding behave under lightning impulse voltage ? With the equivalent circuit of the transformer under such impulse, explain the effect of the incident impulse.
9. Explain Cockcroft-Walton voltage multiplier circuit with relevant circuit diagram and hence derive the optimum stage and maximum output voltage of the generator.
10. Drive the Poisson's equation and hence Laplace's equation. Discuss the different numerical methods of high voltage field estimation. Make a comparative study of the techniques.
11. Write short notes on any *three* of the following :
    a) Electrolytic method of field computation
    b) Measurement of dielectric constant and lens angle
    c) Measurement techniques for impulse current
    d) Generation of switching surge
    e) Representation of multistage impulse generator by single stage impulse generator