

Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH(EE-NEW)/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 :

$10 \times 1 = 10$

- i) Average electrical field is the magnitude of electrical field
- a) at mid-point between conductors
 - b) ratio of potential difference to the distance between the conductors
 - c) at surface of the lower potential electrode
 - d) ratio of potential difference to half the distance between the conductors.

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ii) An experimental method for computing the field distribution is

- a) solution of Laplace equation**
- b) electrolytic tank method**
- c) digital simulation**
- d) field intensity method.**

iii) Field enhancement factor is the ratio of

- a) maximum field to average field**
- b) rms value to electric field to average value**
- c) potential difference to radius of the conductor**
- d) electric field at the surface of the h.v. conductor to electric field at ground conductor.**

iv) A unique feature of the Boundary Element Method is that

- a) it can be used for electric fields which are uniform only**
- b) it can be used only with bounded fields**
- c) electric field is proportional to the charge densities on an enclosed electrode which is simulated by real charges**
- d) none of these.**

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- v) Finite Element Method can be used only
 - a) with fields which are bounded
 - b) with fields which are unbounded
 - c) with fields which are both bounded and unbounded
 - d) when high accuracy is not required.
- vi) A comparison of the accuracies of various computational methods shows a good agreement between the results of
 - a) FEM and FDM
 - b) FDM and BEM
 - c) FEM and CSM
 - d) BEM and FEM.
- vii) Corona discharge is
 - a) an internal discharge
 - b) surface discharge
 - c) a spark between conductors
 - d) partial discharge around a high voltage conductor.

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viii) Partial discharge magnitude is

- a) quantity of charge measured at the terminals of the specimen
- b) quantity of charge inside a specimen
- c) voltage across the terminals of a specimen
- d) average current through the terminals of the specimen.

ix) Partial discharge detector is a device that measures or detects

- a) a partial discharge
- b) corona discharge
- c) leakage current
- d) fault current.

x) 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.

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xi) The discharge energy in a partial discharge in terms of discharge magnitude q and inception voltage v is

- | | |
|-----------------|-------------------|
| a) q_{vt} | b) $0.707 q_{vt}$ |
| c) $0.5 q_{vt}$ | d) $1.414 q_{vt}$ |

GROUP - B**(Short Answer Type Questions)**Answer any *three* of the following. $3 \times 5 = 15$

2. Explain the difference between photo-ionization and photo-electric emission.
3. Discuss the advantages and limitations of Charge Simulation method.
4. How would you measure dielectric constant and loss angle for a cable ?
5. How would you measure resistivity of a dielectric ?
6. What are formative and statistical time lags ? Explain.

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GROUP - C

(Long Answer Type Questions)

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

7. What is PD ? Find out the relation between measured charge and apparent charge in case of a PD. Draw the PD equivalent circuit for a cavity within a dielectric. Write down the different techniques of PD measurement. $2 + 7 + 3 + 3$
8. What are the different types of voltage dividers used in HV laboratory ? Describe the method of impulse voltage measurement with the help of such dividers with proper mathematical analysis. $3 + 12$
9. a) Draw the circuit diagram and explain the principle and operation of Cockcroft-Walton cascade rectifier circuit for generation of high d.c. voltage.
 b) Derive an expression for the voltage drop in a loaded Cockcroft-Walton voltage multiplier circuit. Also, derive the expression for the ripple voltage. $3 + 6 + 6$
10. Explain the mechanism involved in the breakdown of vacuum.

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

- a) Electron attachment and its role in the breakdown of electronegative gases.
 - b) Voltage measurement by sphere gaps.
 - c) Determination of front and tail time of lightning impulse wave as per I.S.
 - d) Generation of high impulse current.
 - e) Discharge characteristics of a rod-plane gap in air.
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