



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.*

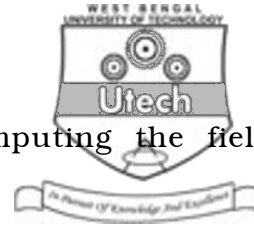
**GROUP – A**

**( 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.



- 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.



- 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.



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.



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

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

**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.



**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.



11. Write short notes on any *three* of the following :  $3 \times 5$

- 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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