

Benha University		Time : 3 Hours
Faculty of Engineering (Shoubra)		High Voltage Engineering
Electrical Engineering Dept. 9 July, 2012		Third Year (Power) Final Exam.

Attempt All Questions

**Question One (15 Mark) Choose the Correct Answer**

- The field enhancement factor is the ratio of
  - Maximum field to average field
  - r.m.s. value of electric field to average value
  - electric field at surface of HV conductor to electric field at ground conductor
- Most suitable numerical method to solve electrostatic field problems is
  - Laplace equation method
  - Charge simulation method
  - finite difference method
  - none of the above
- The breakdown criterion in a uniform field electrode gap is
  - $e^{\alpha d} = 1$
  - $\gamma e^{-\alpha d} = 1$
  - $\gamma e^{\alpha d} = 1$
  - $e^{\alpha d}/\gamma = 1$
- Time lag for breakdown is
  - time difference between instant of applied voltage and occurrence of breakdown.
  - time taken for the voltage to rise before breakdown occurs.
  - time required for gas to breakdown under pulse application.
  - none of the above
- For a gap spacing 1 cm in air at 760mm pressure and 20C<sup>0</sup> temperature the breakdown voltage is;
  - 24kV
  - 40 kV
  - 30.0 kV
  - 22.92 kV
- Tan  $\delta$  for liquid insulants at 50Hz should be less than;
  - 0.1
  - 0.001
  - 0.01
  - 0.0001
- Conduction and breakdown in commercial liquids is affected by;
  - solid particles
  - Vapour or air bubbles
  - electrode material
  - all the above
- The relation between breakdown strength( $V_b$ ) and gap distance (d) in liquid dielectrics is
  - $V_b = k/d$
  - $V_b = kd^{-n}$
  - $V_b = kd^n$
  - $V_b = k_1d + k_2$
- Paper insulation is mainly used in
  - transformers
  - cables and capacitors
  - rotating machines
  - circuit breakers
- Breakdown is permanent in
  - solid materials
  - gases
  - liquids
  - in all the above

**Question Two (15 points)**

- (A) Mention the different mechanism which have been proposed for study the breakdown in vacuum. Then explain with drawing the particle exchange mechanism.
- (B) The earthing system is an essential part of power networks at both high and low voltage levels. Mention the different functions which must be satisfied by a good earthing system.
- (C) The international standard IEC 60364 distinguishes three families of earthing arrangements, using the two letters codes TN, TT, and IT. Explain with drawing what is the different between These three families of earthing systems.

**Question Three (15 points)**

- (A) Describe briefly various mechanisms of breakdown in solids.
- (B) For a certain gas the first Townsend coefficient of ionization is given by the standard equation with  $A=15 \text{ (cm.torr)}^{-1}$  and  $B =365 \text{ V/cm.torr}$ . If the secondary ionization coefficient is equal to  $10^{-4}$ , Calculate the minimum breakdown voltage and the minimum value of the pressure distance product.
- (C) Explain the phenomena of electrical conduction in liquids. How does it differ from that in gases?

1.a

2.b

3.c

4.a

5.c

6.b

7.d

8.c

9.b

10. a