Mansoura University
Faculty of Engineering
Electrical Engineering Dept.

Post Graduate Course
High Voltage Engineering
September 18, 2013
Time allowed 3 Hrs

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Attempt All Questions

Question # 1:

(A) Name some of the important fields and processes, where high voltage technology plays a major role.

(B) What are the main differences between high voltage test transformers and high voltage power transformers?

(C) In brief, write your understanding to the expression "Insulation Coordination".

Question # 2:

(A) The Greinacher doubler-circuit overcomes the disadvantages of the Villard doubler circuit. Explain this sentence on the hand of circuit diagrams as well as on the hand of voltage curves for both circuits.

(B) Van de Graff belt electrostatic generator is used to generate high voltage D.C. using graphical sketches, explain the working principle of this generator. Compare the ratings of this generator with that of Greinacher.

(C) Explain the working principle of high voltage measurement using electrostatic voltmeters, giving the range and type of voltages to be measured by them.

Question # 3:

(A) Multiplier circuit after Marx is one of the most used impulse voltage generators in high voltage labs. Explain in details, on the hand of a three stage generator graph, the working principle of the generator, giving the main important parameters affecting efficiency and wave shape.

(B) Sphere gaps are used in the Marks generator, name other possible employments of the sphere gaps in the H.V. technology.

(C) Using schematic circuit diagrams, classify the known high voltage deviders according to the voltage types measured by them, giving the necessary cautions to be regarded with each type.

Question # 4:

(A) Draw the current voltage relationship of a spark gap between two parallel ideal plate electrodes and give the Townsend's explanations.

(B) What other ionization processes can happen in gases, other than the process given by Townsend?

(C) Paschen's law is an important tool for high voltage designers. Explain this expression using graphs and deduce the equation of the minimum breakdown voltage value given by Paschen.

Question # 5:

(A) Describe the streamer mechanism in gases and explain in details the factors responsible for the change from the Townsend mechanism to that of streamer mechanism.

(B) Explain how the polarity of electrodes affects the breakdown voltage values (for same arrangements) in nonuniform fields. Support your answer with illustrations, if possible.

(C) What are the main factors affecting the break down in liquids?

Question # 6:

Give the correct answer out of the following statements:

(1) Lab H.V. test transformers are designed for:
   - (a) low power and high voltages
   - (b) high power and high voltages
   - (c) high currents and high voltages

(2) High voltage measuring by sphere gaps gives:
   - (a) the peak voltage value.
   - (b) the mean value of voltage.
   - (c) the r.m.s. value

(3) The peak voltage measuring circuit illustrated in figure uses a current measuring instrument for:
   - (a) measuring r.m.s. value
   - (b) measuring average value
   - (c) measuring peak value

(4) The figure illustrates a peak voltage measuring circuit using capacitive dividers. Thereby R2 is connected parallel to C2:
   - (a) for safety
   - (b) to prevent charging of C2 through DC
   - (c) to compensate the influence of stray capacitances.

(5) High voltage measurements using electrostatic voltmeters are suitable for measuring:
   - (a) only impulse voltages
   - (b) all kinds of voltages
   - (c) DC and power frequency AC voltages

(6) The discharge resistor Re and the damping resistor Rd in impulse generators should be chosen that:
   - (a) Rd>>Re
   - (b) Re>>Rd
   - (c) Rd=Re

(7) By impulse current measurements care should be taken for the influence of:
   - (a) Stray capacitances
   - (b) current loop inductances
   - (c) resistive heating

(8) By inelastic collision, the electrons :
   - (a) do not lose much of their kinetic energy
   - (b) lose most of their kinetic energy
   - (c) gain more kinetic energy

(9) Breakdown in vacuum is mainly characterized through:
   - (a) electron collision process
   - (b) ion collision process
   - (c) cathode secondary emission process

(10) Am bipolar diffusion coefficient gives:
   - (a) unstable condition due to higher diffusion of electrons
   - (b) equilibrium state at which negative and positive ions have same velocity
   - (c) a state of high mobilized diffusion of negative ions under electric field

(11) γ is greatly affected by the nature of:
   - (a) the anode
   - (b) the cathode
   - (c) the gas

(12) The electric field due to space charge plays a dominant role by:
   - (a) the Townsend mechanism
   - (b) the attachment process
   - (c) the streamer mechanism

(13) At normal and high pressures, the breakdown voltage under divergent fields occurs:
   - (a) at higher values for negative polarity
   - (b) at higher values for positive polarity
   - (c) at higher values for AC power frequency stresses.
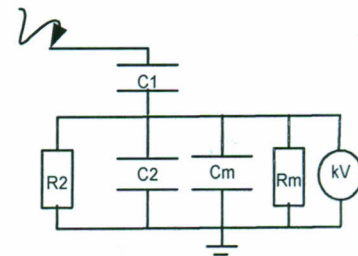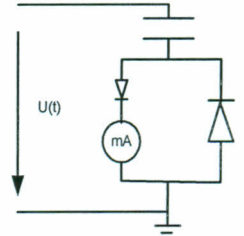
Best Wishes

Prof. Dr-Ing. Fathi M. H. Youssef