Mansoura University
Faculty of Engineering
Electrical Engineering Department

High-Voltage Engineering (EE2316)
3rd year term Examination (Part 1)
Wednesday 9-1-2013
Time allowed: 1.5 Hours

Pls. Answer All the Following Questions (Total Score 50 Marks)

Question 1 (15 Marks):

Explain *briefly* the following (*using equations and/or neat sketches if possible*):

1. The principle of HV generation with resonance circuits and its advantages.   *(5 Marks)*
2. The response of Resistive voltage divider for impulse voltage measurement.   *(5 Marks)*
3. Internal and External partial discharges.   *(5 Marks)*

Question 2 (10 Marks):

1. A 100 kVA, 400 V/250 kV testing transformer has 8% leakage reactance and 2% resistance on 100 kVA base. A cable has to be tested at 500 kV using the above transformer as a resonant transformer at 50 Hz. If the charging current of the cable at 500 kV is 0.4 A, find the series inductance required. Assume 2% resistance for the inductor to be used and the connecting leads. Neglect dielectric loss of the cable. What will be the input voltage to the transformer?   *(5 Marks)*

2. Given is the following basic circuit for measuring of peak voltage values.   *(5 Marks)*

   a) What functions do the resistances R_m and R_2 fulfill?
   b) Discuss the measuring errors, which can be caused by means of R_m and R_2
   c) How can the errors caused by R_m and R_2 be minimized.
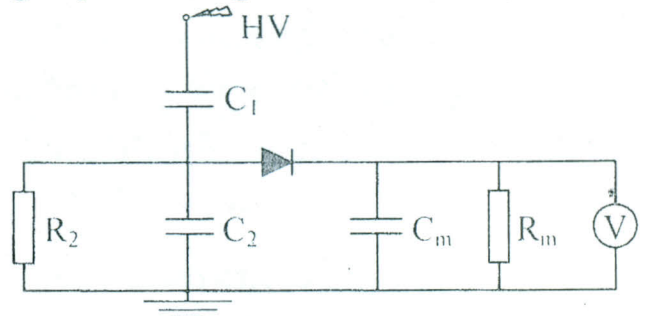
Question 3 (10 Marks):

1. For an energy rating of 8 kWs at 400 kV, design a two stages impulse voltage generator for 1.2/50 μs standard lightning output wave at which $C_s = 20\ C_b$.

   a) Find the values of all the circuit elements and the voltage efficiency.
   b) What is the maximum value of any additional capacitive load that may be connected so that the tolerance limit on T_s is not exceeded?   *(5 Marks)*

2. The following basic circuit is used to generate a HVDC. Assuming all ideal elements and neglecting the voltage drops in the rectifiers and transformer,

   i. Discuss the functioning of the basic circuit on no-load showing the waveforms at points a, b, d, e and the output DC voltage U_{dc}.
   ii. Determine the voltage ratings of the rectifier, condensers.
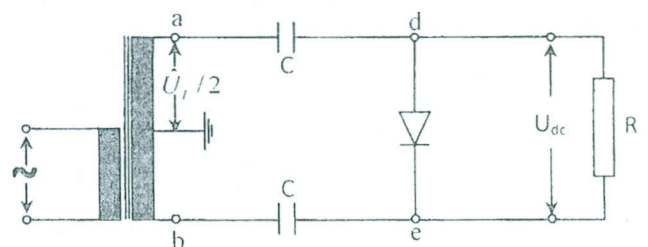
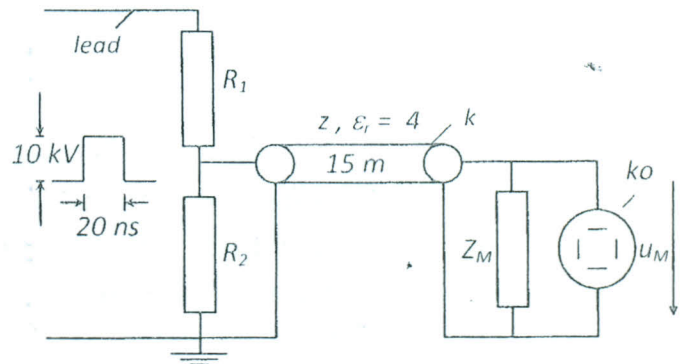   *(5 Marks)*

Question 4 (15 Marks):

1. A solid dielectric specimen of dielectric constant of 4.0 as shown in the figure has an internal void of thickness 1 mm. The specimen is 1 cm thick and is subjected to a voltage of 80 kV (rms). If the void is filled with air and if the breakdown strength of air can be taken as 30kV peak/cm, find the voltage at which an internal discharge can occur.
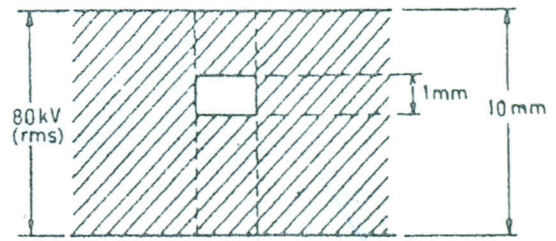
(5 Marks)

2. Given is a voltage measuring system with which a rectangular voltage impulse is to be measured. At the time t= 0 the impulse reaches the time lag free.

   The divider ratio is 1000:1. The length of the cable is 15 m and the damping can be neglected.

a) Give for $R_2 = Z = Z_M$ the course of U_M in the time zone $0 \leq t \leq 0.2$ μsec.

b) If $R_2 = 2Z$; $Z_M = \infty$. Give qualitatively the course of the measured voltage U_M in the time zone $0 \leq t \leq 0.8$ μsec.

(10 Marks)

Good Luck and with my Best Wishes   Dr. Eng. Mohamed ELADAWY

El-Mansoura University
Faculty of Engineering
Electrical Engineering Department   **Part (2)**

Third year
High Voltage Engineering
Time allowed: three hours

Answer all the following questions

Question (1)

a) Describe the current growth phenomenon in a gas subjected to uniform electric fields.

b) State and explain Paschen's law. How do you account for the minimum voltage for breakdown under a given pd condition?

c) Explain the streamer theory of breakdown in gases.

d) Explain clearly the mechanism of corona formation on a two conductor line?

Question (2)

a) Explain the various theories that explain breakdown in commercial liquid dielectrics.

b) Explain thermal breakdown in solid dielectrics. How this mechanism is more significant than the other mechanisms?

c) Explain clearly the treeing process in solid dielectrics.

d) What is a composite dielectric and what are its properties?

Question (3)

a) What is meant by the re-ignition surges?

b) Explain with neat sketches the mechanism of lightning discharge.

c) What is meant by insulation co-ordination? Discuss briefly the function of surge modifiers and surge diverters?

With my best wishes

Dr. Esam Ali Saafan