Menoufia University Faculty of Engineering, Shebin El-Kom Electrical Engineering Department First Semester Examination, 2013-2014 Exam Date : 16 / 1 / 2014	جامعة المنوفية	Subject: Traceable Measurements in High Voltage Tests Code: ELE 534 Year: Diploma Time Allowed : 3 hours Total Marks : 100 marks

Answer the following questions.

Question 1 (30 marks)

(a) Explain with neat sketches cockroft-Walton voltage multiplier circuit. Explain also clearly its operation when the circuit is:

    (i)   Unloaded   (ii) loaded   (20 marks)

(b) Discuss the advantages and disadvantages of the generation of high a.c voltage by high voltage transformer and high voltage resonant transformer.   (10 marks)

Question 2 (20 marks)

(c) Describe the construction of uniform field spark gap and discuss its advantages and disadvantages for high voltage measurements.   (10 marks)

(d) Draw a simplified equivalent circuit of a resistance potential divider and discuss its step response. Discuss the relative advantages and disadvantages of using a series resistance with microammeter for measuring high voltage DC.   (10 marks)

Question 3 (20 marks)

(a) State the role of measurement traceability in the product quality.   (5 marks)

(b) Discuss the necessary of standardization and differentiate between different standards.   (5 marks)

(c) Demonstrate the requirements of accreditation laboratory.   (5 marks)

(d) Demonstrate the traceability chart for DC high-voltage measurements. Then, show the arrangement of reference divider with the test one.   (5 marks)

Question 4 (30 marks)

A high-voltage disconnector with a rated voltage of 300 kV is type tested for its short duration power frequency withstand voltage. The specified test voltage for the phase to earth insulation is 395 kV rms. The applied test voltage is measured with a high-voltage voltmeter in its peak detecting mode. sensitivity coefficients with respect to temperature, absolute humidity, air pressure, discharge length of the insulation and 50% disruptive discharge voltage are 0.000 643/°C, 0.002843/g/m3, 0.0019954/kPa, 0.0118453/m and -0.0000497215, respectively. Compute:

o The sensitivity coefficients for the applied test voltage,

o Standard uncertainty for the following uncertainty components which are assumed to have a rectangular distribution:

- A semi-range a1 = 2.0 °C uncertainty for temperature,
- A semi-range a2 = 1.3 g/m3 uncertainty for absolute humidity,
- A semi-range a3 = 0.35 kPa uncertainty for air pressure,
- A semi-range a4 = 0.02 m uncertainty in the length of the discharge path the test object,
- A semi-range a5 = 18.43 kV uncertainty in the 50% disruptive discharge voltage ,

o The combined standard uncertainty of the test voltage. With the aid of above results and following data: Standard uncertainties for uncertainty of the calibration ac high-voltage voltmeter, reading resolution of the ac voltmeter, drift of the calibration of the voltmeter, temperature effect on the voltmeter and voltage non linearity of the voltmeter are 0.3718, 0.866, 0.225, 0.225 and 1.803, respectively.

With our best wishes

Prof. Dr. Mohamed Izzularab

Dr. Nehmdoh Sabiha

This exam measures the following ILOs							
Skills	Knowledge &Understanding Skills		Intellectual Skills		Professional Skills		
	a1.2	a1.3	b2.1	b3.1	c1-1	c1.2	c1.3
Question Number	Q3-a	Q3-b	Q-4	Q2	Q3-d	Q3-b	Q3-c