



Answer the following questions and assume any missing data

Question 1

(25 marks)

- (a) Read the following statements, then check [\checkmark] or [\times] in front of each. Rewrite the wrong sentence after corrections.
- a.1 The use of sphere gap is not recommended for voltage measurements of wave fronts less than 0.5 μs and wave tail less than 5 μs . []
 - a.2 The Van de Graaff generator is usually enclosed in an earthed metallic cylindrical vessel and is operated under pressure or in vacuum. []
 - a.3 For metal oxide arrester, gaps to isolate the material from the power frequency voltage are unnecessary because of the sharp turn-on characteristics of the metal oxide. []
 - a.4 The main source of lightning is rainstorms and it is rarely occurred during snowstorms. []
 - a.5 In Cockcroft-Walton voltage multiplier, it is not desirable to use the optimum number of stages for the minimum voltage drop. []
- (b) Explain the post-breakdown phenomena in gases.
- (c) Explain the various theories that explain breakdown in commercial liquid dielectrics.

Question 2

(15 marks)

Coaxial cable consists of two insulation layers with 1 cm thickness for each one. The first layer, which is close to the high voltage conductor, has a dielectric constant 4 and the second layer, which is close to the sheath, has dielectric constant 3.8. If the working voltage of the cable is 11 kV, calculate the minimum diameter of the air void that is formed between the two layers and producing internal discharge.

Question 3

(15 marks)

- (a) Discuss the operation principle of a resonant transformer with declaring its advantages and disadvantages.
- (b) A 12-stage impulse generator has 0.126 pF condensers. The wave front and the wave tail resistances connected are 800 Ω and 5000 Ω , respectively. If the load condenser is 1000 pF, find the front and tail times of the impulse wave produced.

Question 4

(15 marks)

- (a) State the limitations of using high ohmic series resistance with microammeter for measuring high voltage DC.
- (b) A capacitive potential divider has a standard compressed gas high voltage capacitor of 100 pF. The low voltage arm has capacitance of 100 nF. The divider is connected to an electrostatic voltmeter via a connecting cable. What is the value of the ac applied voltage if the meter reading is 500 V with neglecting the capacitances of connecting cable, leads and meter.
Replacing the high impedance an electrostatic voltmeter with low impedance voltmeter needs some modifications to the capacitive divider. State these modifications.

Question 5

(20 marks)

- (a) State the basic tasks of overhead transmission lines insulation coordination.
- (b) AB transmission line (TL) with length 30 km and surge impedance 300 Ω is connected at B to a cable with surge impedance 60 Ω and length 20 km. The cable is terminated with resistance 500 Ω. 50 kA surge current, negligible rising time and infinite decaying time hits the interconnection junction B. The surge propagation velocity is 3×10^8 m/s in the TL and 2×10^8 m/s in the cable. Find:
 - 1. The incident voltage.
 - 2. Overvoltages at Junction A and at the end of the cable using Bewley lattice diagram at an instant 300 μs concerning the following circumstances of the junction A:
 - Open breaker,
 - A source of zero impedance.

With our best wishes

Prof. Dr. Mohamed Izzularab and Dr. Nehmdoh Sabiha

This exam measures the following ILOs							
Skills	Knowledge & Understanding Skills			Intellectual Skills			Professional Skills
	a1-1	a8-1	a8-2	b5-1	b5-2	b13-1	e5-2
Question Number	Q1b,c	Q1a, Q3a, Q4a	Q1a, Q5a	Q5b	Q4b	Q2	Q3b