



Answer the following questions

Question 1

(30 marks)

- (a) Discuss the flashover mechanism across H.V. insulator surfaces in air.
 (b) Explain the characteristics of mean breakdown gradient of rod-plane gaps under impulse, alternating and D.C voltages as a function of gap length.

Question 2

(25 marks)

- (a) Expand the following abbreviations for insulation type: HPOF, XLPE, PPLP and SF6. Then declare the construction of each type.
 (b) What are the average values of ϵ_r , $\tan \delta$, and withstand kV/mm of un-impregnated Kraft paper, impregnated Kraft paper, PPLP, XLPE, and SF6?
 (c) Classify the cooling types of extra high voltage cables with declaring the laying methods in the soil.

Question 3

(20 marks)

- (a) Discuss the effect of temperature on breakdown stress in extra high voltage cables.
 (b) A 3-phase 275 kV cable system consisting of 3 single-core cables is designed to operate at a maximum voltage of 287 kV, line-to-line. Its life is expected to be 30 years. In the factory, a 15 minute test is intended to be given. Taking $n = 12$, calculate the magnitude of test voltage to be applied between conductor and sheath that will simulate service conditions using maximum continuous voltage as the basis for design.

Question 4

(25 marks)

- (a) Describe with neat sketches the mechanism of lightning stroke contacting (1) a tower, and (2) midspan.
 (b) Compare the performance characteristics of silicon carbide arrester with a zinc oxide arrester. What are the advantages and disadvantages of each?
 (c) A tower has a 40 ohm footing resistance and two ground wires each with $Z_g = 500$ ohms. The lightning stroke surge impedance is $Z_s = 400$ ohm. For $I_s = 50$ kA, crest, calculate the tower top potential (1) considering all impedances, (2) neglecting the ground wire and stroke surge impedances, and (3) considering only one ground wire and stroke surge impedance.

With our best wishes

Prof. Dr. Mohamed Izzularab and Dr. Amr Abdelhady

This exam measures the following ILOs

Skills	Knowledge&Understanding Skills				Intellectual Skills			Professional Skills
	a1.1	a1.2	a1.5	a1.3	b1.2	b5.1	b5.3	c4.3
Question Number	1b	1a	2a,c	4a,c	2b	1c	4b	3