



Answer the following questions

Question 1

(25 marks)

(1-a) Discuss the flashover phenomena across H.V. insulator surfaces in air considering mechanisms and critical voltage calculations of the flashover.

(1-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.

(1-c) Discuss the pre-breakdown discharges phenomena.

Question 2

(25 marks)

(2-a) Explain the Obenaus flashover model of high voltage insulators considering physical, and electrical models.

(2-b) Discuss briefly the effect of atmospheric conditions, density of air, and humidity on flashover voltage of high voltage insulators.

Question 3

(25 marks)

(3-a) Discuss the lightning mechanism.

(3-b) Compare between lightning overvoltages protection considering spark gap and surge arresters.

(3-c) Compare the performance characteristics of silicon carbide arrester with a zinc oxide arrester. What are the advantages and disadvantages of each?

(3-d) Explain how to select surge arrester rating in extra high voltage system. Give an example.

Question 4

(25 marks)

(4-a) What are the types of extra high voltage cables considering their constructions?

(4-b) Discuss the effect of temperature on breakdown stress in extra high voltage cables.

(4-c) 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.

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,b,c	4a,c	3c	1c	4b	3a,b,d