Answer the following questions

Question 1 (25 marks)

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

(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 briefly the effect of atmospheric conditions, density of air, and humidity on flashover voltage of high voltage insulators.

Question 2 (15 marks)

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

(2-b) Explain the different techniques used in the washing of high voltage insulators.

Question 3 (30 marks)

(3-a) Discuss the lightning mechanism including upward and downward initiated discharge.

(3-b) Explain how the lightning affecting power systems considering induced overvoltage, shielding failure, and backflashover scenarios.

(3-c) Discuss how to select surge arrester rating considering a high voltage system of 220 kV.

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

Question 4 (30 marks)

(4-a) Compare between the different extra high voltage cable types considering their constructions and insulation properties.

(4-b) Write short notes on: Temperature deterioration coefficient- Life expectancy factor- Safety factors.

(4-c) Classify the cooling types of extra high voltage cables with declaring the laying methods in the soil.

(4-d) A series of power-frequency tests conducted on samples of 187 kV XLPE cable gave the following breakdown probability figures and corresponding electric stresses: $P_1=20\%$ at $E_1 = 35.2$ kV/mm; $P_2=50\%$ at $E_2=38$ kV/mm; and $P_3=90\%$ at $E_3=43$ kV/mm. Calculate the values of E_L, b, and E_0 and write the Weibull breakdown probability function for this type of voltage.

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