

Fakulti: <b>FAKULTI KEJURUTERAAN ELEKTRIK</b>	
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**SEE 4722**

**FAKULTI KEJURUTERAAN ELEKTRIK  
UNIVERSITI TEKNOLOGI MALAYSIA  
SKUDAI, JOHOR**

**INSTITUT VOLTAN DAN ARUS TINGGI (IVAT)  
PROBLEM (Experiment 10)**

**AC Voltage Distribution over a String of Suspension Insulators**

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## **Introduction:**

Insulation is a main subject in high voltage engineering. It plays an important role in maintaining the performance and the safety of the electrical power apparatus. Electric power supply should ensure reliability and continuity to the utility concerned, hence the power lines and sub-stations are to be operated and protected against overvoltages such that the numbers of failures are as few as possible. At the same time, the cost involved in the design, installation and operation of the protective devices should not be too high.

In order to prevent the flow of current to the earth from support the transmission lines or distribution lines are all secured to the supporting towers or poles with the help of insulators. Thus the insulators play an important part in the successful operation of the lines. Insulators not only must have sufficient mechanical strength to support the physical loads, but must be so designed to withstand severe electrical and environmental stresses without mechanically failing. It has been reported that most of the electrical power supply breakdowns are due to the insulation failure. For proper design and safe and reliable operation of the insulation system, knowledge of the physical and chemical phenomena which determine the dielectric properties of the insulating material is very important.

Most of high voltage insulators are being used in outdoor applications. Environmental pollution can cause the insulators to become progressively coated with dirt and chemicals in the long run. The contamination level of the insulator is determined from the Equivalent Salt Deposit Density (ESDD). Under high electric field stress, the level of leakage current (LC) varies with the contamination level of the insulator. These LC and ESDD will influence the insulation performance as well as the dielectric properties of the insulator.

Suspension type insulators are commonly used especially in the transmission. As the line voltage increases, the pin insulator to be used becomes heavy and complicated its construction as well as increases the cost. Further the replacement of the damaged insulator will cost more. So, pin insulators are not economic to be used for higher voltages. For higher voltages, suspension

insulators are used. A number of them are connected in series by metallic links to form a chain and the line conductor is carried by the bottom-most insulator

## **Problem Statement**

*You are working as a project engineer in the Transmission and Distribution Unit of an electrical power supply company. Your tasks are to design and develop the transmission line system that using suspension insulators. Your teams need to conduct a study of voltage distribution on cleaned and contaminated insulators in order to study the effect of environmental contamination to the insulator performance.*

*You are given four weeks by the head of Transmission and Distribution Unit to submit a technical report on the effect of contaminated insulators to their voltage distribution as well as the efficiency of the system. Your report must include some simulation study and the experimental work that could verify your findings.*

## **Trigger**

The levels of insulation performance are depended on breakdown voltage, leakage current and the insulating properties.

- 1) What is the definition of insulating properties and how do you relate with the performance of the insulator?
- 2) What is the function of suspension insulators and how they work to protect the flashover of high tension transmission?
- 3) How the process of degradation occurs which leads to the surface flashover of contaminated insulators?
- 4) What should you do so that the insulation performance can be maintained in good condition for the long run?