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| **Course Name:** | **EEEE** | **Semester:** | **I** |
| **Date of Performance:** | **3/ 11/ 2023** | **Batch No:** | **C4-1** |
| **Faculty Name:** |  | **Roll No:** | **16010123217** |
| **Faculty Sign & Date:** |  | **Grade/Marks:** | **/25** |

**Experiment No: 5**

**Title: Power factor improvement (parallel)**

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| **Aim and Objective of the Experiment:** |
| * To improve power factor of a single phase inductive AC circuit using capacitor across the load. |

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| **COs to be achieved:** |
| **CO2:** Demonstrate and analyze steady state response of single phase and three phase circuits |

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| **Requirements:** |
| Inductor box, 1 KΩ-3W Resistor, Capacitor box, AC Ammeter and AC Voltmeter, 0-230V auto-transformer. |

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| **Theory:** |
| When we need to convert electrical energy to mechanical energy, electric motors are used for it. These AC motors converts electric energy in two forms namely mechanical energy in the form of rotary motion and other is magnetic field. Magnetizing currents are lagging to the supply voltage. This magnetic energy is not a mechanical energy so it is kind of wastage, but without which motor will not run and convert electric energy into mechanical energy. Such form of energy is called as reactive power. Reactive power must be as less as possible so that the load will utilize maximum power and current requirement will be less for the same amount power. As the current requirement is less, so wire thickness will be small in diameter. Installation cost and energy cost will be also reduced. To reduce reactive power of the circuit, different power factor improvement methods are used. One of the most familiar method is the use of capacitor bank. We can use capacitor in series with the load or across the load. Following diagrams are illustrating effect of PF on active power.  https://upload.wikimedia.org/wikipedia/commons/thumb/2/23/Power_factor_0.svg/300px-Power_factor_0.svg.png  In the above figure instantaneous and average power calculated from AC voltage and current with a zero power factor{\displaystyle \cos \varphi =0}. The blue line shows all the power is stored temporarily in the load during the first quarter cycle and returned to the grid during the second quarter cycle, so no real power is consumed by the load which is shown by sky-blue colour line.  what is reactive power in electrical à¤¸à¤¾à¤ à¥ à¤à¤®à¥à¤ à¤ªà¤°à¤¿à¤£à¤¾à¤®  In the above figure instantaneous and average power calculated from AC voltage and current with a unity power factor{\displaystyle \cos \varphi =0}. The gray part shows all the power is absorbed in the load during the first half cycle as well as the second half cycle, so real power is fully consumed.  When power factor is between zero and unity, then real power consumed by the load depends upon PF of the circuit. Greater the power factor is always better to consume power.  BEEE_writeup |

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| **Circuit Diagram:** |
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| **Stepwise-Procedure:** |
| **1**. Connect series R and L circuit across 50V, 1ø, 50 Hz AC supply and note down circuit voltage and current.  **2**. Calculate practical value of circuit power factor by taking ratio of active power (P) and apparent power (S).  **3**. Connect required value of capacitor in parallel with R-L load and switch on power supply to note circuit voltage and current.  **4**. Calculate practical value of circuit power factor by taking ratio of active power (P) and apparent power (S).  **5.** Compare theoretical and practical values of PF before connecting the capacitor and after connecting capacitor. |

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| **Observation Table:** |
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| **Calculations:**  Theoretical Calculations to find circuit current and PF of the circuit:  Practical calculations to find PF of the circuit:  Calculations to find value of the capacitor to be connected across the load:  Practical calculations to find improved PF of the circuit: |
| **Post Lab Questions:** |
| 1. What are benefits of connecting capacitor across the load to improve circuit PF?   Ans. Connecting a capacitor across the load in a circuit can improve the power factor (PF) in several ways:   1. Increased Load Carrying Capabilities in Existing Circuits: By improving the power factor, the existing circuits can carry more load without the need for expensive upgrades. 2. Improved Voltage: A better power factor can result in improved voltage in the circuit, reducing the risk of voltage drops. 3. Reduced Power System Losses: Power losses in the system can be reduced by improving the power factor. 4. Neutralize Reactive Power: Capacitors supply leading current, which balances out the lagging inductive component of the load current. This effectively eliminates or neutralizes the lagging component of the load current and corrects the power factor of the load circuit to enhance the overall efficiency. 5. Efficient Utilization of Electrical Power: A high power factor signals efficient utilization of electrical power, while a low power factor indicates poor utilization of electrical power. |

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| **Conclusion:** |
| 1. The experiment successfully demonstrated that the power factor of a single-phase inductive AC circuit can be improved by connecting a capacitor across the load. This is because the capacitor supplies a leading current which counteracts the lagging inductive component of the load current. 2. The use of a capacitor not only improved the power factor but also enhanced the overall efficiency of the circuit. This is a significant finding as it suggests a practical and effective method for power factor correction in real-world applications. 3. The experiment provided valuable insights into the role of capacitors in power factor correction and their potential benefits in enhancing the performance and efficiency of electrical circuits. |

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| **Signature of faculty in-charge with Date:** |