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| **Course Name:** | **Electronic Circuits Analysis and Design** | **Semester:** | **IV** |
| **Date of Performance:** | **22/03/2021** | **Batch No:** | **B2** |
| **Faculty Name:** | **Prof. Sonia Joshi** | **Roll No:** | **1912052** |
| **Faculty Sign & Date:** |  | **Grade/Marks:** | **/25** |

**Experiment No: 6**

**Title: To study Power Amplifier**

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| **Aim and Objective of the Experiment: Implementation of Class B and Class AB Power Amplifier** |
| 1. To Implement the Class B and Class AB Power Amplifier 2. To Understand Crossover Distortion 3. Calculate the Efficiency of Class B Power Amplifier   . |

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| **COs to be achieved:** |
| CO 3. Understand the need of Power Amplifiers and Differential Amplifiers |

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| **Theory:** |
| Power amplifier is meant to raise the power level of the input signal. In order to get large power at the output, it is necessary that the input-signal voltage is large. That is why, in an electronic system, a voltage amplifier always precedes the power amplifier, also, that is why power amplifiers are called large-signal amplifiers. In fact, power amplifier does not amplify power. What a power amplifier actually does is that it draws power from dc supply connected to the output circuit and converts it into useful ac signal power. The type of ac power available at the output terminals of the power amplifier is controlled by the input signal. Thus a power amplifier may be defined as a device that converts dc power and whose action is controlled by the input signal. The transistors employed in power amplifiers are called power transistors.  They differ from other transistors in the following respects.  (i) The base is made thicker to handle large currents i.e.in power amplifiers;  Transistors with comparatively smaller gain are used.  (ii) The area of collector region of a power transistor is made considerably larger in order to dissipate the heat developed in the transistor during operation. Moreover, heat sinks are used for improving the heat dissipation.  (iii) The emitter and base layers are heavily doped. The contact area between the base layers and base leads is in ring like form so that the area is increased. By doing so ohmic resistance between emitter and base is reduced and due to low resistance, small power is required at input.  **Classification of Power Amplifier**  The power amplifiers are primarily divided into two categories:  1. Audio-power amplifiers – also called the small signal power amplifiers, raise the power levels of signals that have audio-frequency range (20Hz- 20 KHz)  Radio-power amplifiers – also called large signal power amplifiers raise the power level of signals that have radio frequency range. They amplify a specific frequency or narrow band of frequencies while rejecting all other frequencies.  **Classification According To Mode of Operation**   * Class A * Class B * Class AB * Class C   **Class A**  In case of Class A power amplifier, the output Q point is located on the centre of load line. Hence, collector current flows for complete cycle. Power dissipation is high across transistor. Its main advantage is that it avoids DC current component flowing through load RL, which reduces power drawn from supply, and then improving efficiency of amplifier is transformer coupled Class A power amplifier is 50%.  **Class B**  In this case, the transistor bias and signal amplitude are such that output current flows only during positive half cycle of the input signal. At zero signals, the collector current is zero and no biasing system is required in class B amplifiers. The operating point is selected at collector cut-off voltage; Because of total absence of negative half cycle from the output the signal distortion is high. Zero signal input represents the best condition for class B amplifiers because of zero collectors current. The transistor dissipates more power with increase in signal strength. In comparison to class A amplifiers average current is less, power dissipation is less. So overall efficiency is increased. The theoretical efficiency in class B operation is about 78.5%  **Class AB**  Class AB amplifier output stage combines the advantages of the Class A amplifier and the Class B amplifier producing a better amplifier design.  The amplifiers two output transistors conduct somewhere between 180o and 360o of the input waveform. |

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| **Circuit Diagram:** |
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| **Stepwise-Procedure:** |
| 1. Make the connections as per the Circuit diagram. 2. Select the transient response from Edit Simulation command 3. Calculate Frequency from the waveform 4. Measure the Amplitude of the sinusoidal waveform 5. Observe the Cross over distortion |

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| **Observation Table:** |
| Class B and Class AB Power Amplifier   |  |  |  | | --- | --- | --- | |  | Peak Voltage across Load (Vpeak) | Peak current through load (Imax) | | Class B | 17.18518 V | 2.14814 A | | Class AB | 17.67527 V | 2.2094 A | |

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| **Calculation:** |
| Class B Power Amplifier:  Pin (dc) = Vcc x Icq =  Po (ac) = Vorms x Iorms =  % η = =  Class AB Power Amplifier:  Pin (dc) = Vcc x Icq =  Po (ac) = Vorms x Iorms =  % η = = |

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| **Waveform** |
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| **Post Lab Subjective/Objective type Questions:** |
| 1. **Describe briefly Power BJT and Power MOSFET**   Power Bipolar Junction Transistor (BJT) is the first semiconductor device to allow full control over its Turn on and Turn off operations.  A power MOSFET is a specific type of metal–oxide–semiconductor field-effect transistor (MOSFET) designed to handle significant power levels. Compared to the other power semiconductor devices,   1. **What is Crossover Distortion? Explain it**   Crossover distortion is a type of distortion which is caused by switching between devices driving a load. It is most commonly seen in complementary, or "push-pull", Class-B amplifier stages, although it is occasionally seen in other types of circuits as well.   1. **Why are power transistors provided with heat sinks**   Heat sinks are used for power transistors as the power dissipated at their collector junction is large. If heat dissipation is not done, this will cause large increases in junction temperature. |

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| **Conclusion:** |
| We implemented the Class B and Class AB Power Amplifier, understood Crossover Distortion, calculated the Efficiency of Class B Power Amplifier  . |

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