Design and Implementation of a Class-D Audio Amplifier

- **Software used – KiCAD**

The amplifier operates by converting the input analog audio signal into a high-frequency pulse-width modulated (PWM) signa**l**. This PWM signal drives switching transistors operating in saturation and cutoff regions, resulting in high efficiency. A passive low-pass filter is used at the output stage to recover the amplified audio signal by attenuating high-frequency switching components.

- **Circuit Description**

1. **PWM Carrier Generation** : A NE555 timer IC is configured in astable mode to generate a stable high-frequency carrier waveform. Component values are selected to ensure the switching frequency remains significantly higher than the audio frequency range, enabling effective modulation and filtering.

2. **PWM Modulation** : An LM741 operational amplifier is configured as a comparator. The audio input signal is compared against the carrier waveform generated by the 555 timer. This comparison produces a PWM output whose duty cycle varies proportionally with the instantaneous amplitude of the audio signal.

3. **Power Switching Stage** : A complementary NMOS–PMOS half-bridge configuration is employed to switch the load efficiently. The MOSFETs are driven directly by the PWM signal, ensuring low conduction losses and improved power efficiency.

4. **Output Filtering** : An LC low-pass filter is implemented at the output stage to suppress high-frequency switching components and reconstruct the amplified analog audio signal delivered to the speaker load.

Note: The values of Inductor, Capacitors and Resistors are taken by simulation.