Experiment 5:
Diode Rectifier Circuits

Post-Lab Report

A. Rectifier Design Characteristics

- How is the current rating of the transformer secondary calculated?

I2=I1*(N1/N2) where: N1 & N2 are respectively the number of turns of the primary & secondary coil.
I1 is the current rating of the transformer primary.

- Compare the three circuits for each of the characteristics 1 to 6 listed in the theory section. What is the regulation mainly due to?

_DC output voltage VDC is the highest for center-tapped full- wave rectifier, lower for bridge full-wave rectifier (=|Vin|), and the lowest for half-wave rectifier. The full wave-rectifiers have a greater VDC than the half-wave rectifier.

_Ripple-factor: The three circuits have approximately the same ripple Vpp. The bridge rectifier has a ripple Vpp slightly less than the other due to the presence of two conducting diodes.
_Average and peak currents in each diode.
The average and peak currents in the rectifiers are the greatest in the half-wave rectifier, and they are approximately equal in both full-wave rectifiers.

- Under what conditions would each of the circuits be most advantageous?

_Full- wave rectifiers circuit is most advantageous for supplying power for small intervals of time.
_Bridge- full- wave rectifiers circuit is cheaper and easier to construct than center-tapped ones.
_Half- wave rectifier circuit is advantageous for charging purposes because charging takes more time and thus needs power for a large interval of time (the case where full-wave rectifier isn't advantageous).

B. Full Wave Rectifier with Capacitor (Fig.4)

- Does V_{DC} increase appreciably with C for all values of C?

VDC increases exponentially as the value of C increases.

- Does V_r decrease appreciably with C for the values of C used in the experiment?

Vr decreases exponentially with the values of C but not appreciably

- Under what conditions are the approximate relations in the Theory section adequate for calculating V_r and V_{DC}?

A capacitor must be connected in parallel to the rectifier output to smooth the voltage variations and thus the conditions for the approximate relations are valid.

- How does the presence of the capacitor affect the regulation of the circuit?

The presence of a capacitor connected in parallel with the load stabilizes and maintains the output voltage, decreases Vr and thus decreases the ripple voltage.

- What additional current rating of diodes must be considered for the capacitor filter?

The model of the diodes whether ideal, constant-voltage drop or piecewise-linear must be considered.

- For a certain required ripple voltage and DC voltage/current at the load: what should be the RMS voltage rating of the secondary of the transformer? what should be the value of the capacitor?

V2max=VDC+Vr/2
Vr=V2max/(2*f*RL*C)
C=V2max/(2*f*RL*Vr)