

# **AC VOLTAGE SOURCES**

Lesson 5

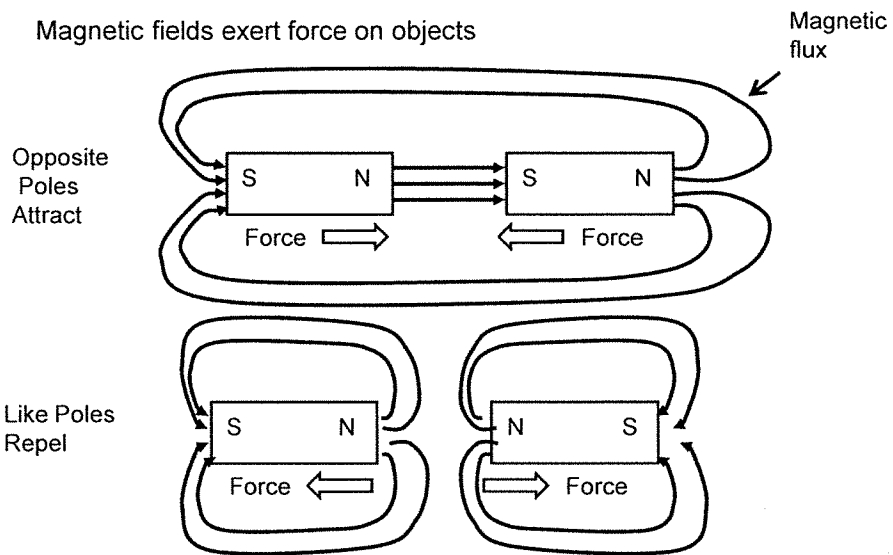
EET 150

## **Ac Sources Learning Objectives**

- ▣ In this lesson you will:
- ▣ learn how magnetic dipoles interact.
- ▣ see how electromagnets are constructed
- ▣ observe changes in magnetic fields for dc and ac currents
- ▣ see how generators create ac voltage
- ▣ see how transformers operate
- ▣ learn schematic symbols for ac generators and transformers
- ▣ study a block diagram for a typical laboratory dc power supply

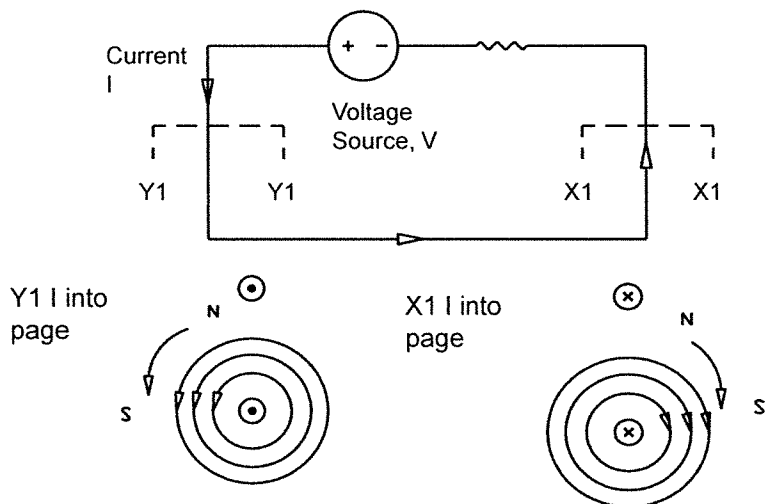
## Magnetism and Ac Voltage

Magnetic fields exert force on objects



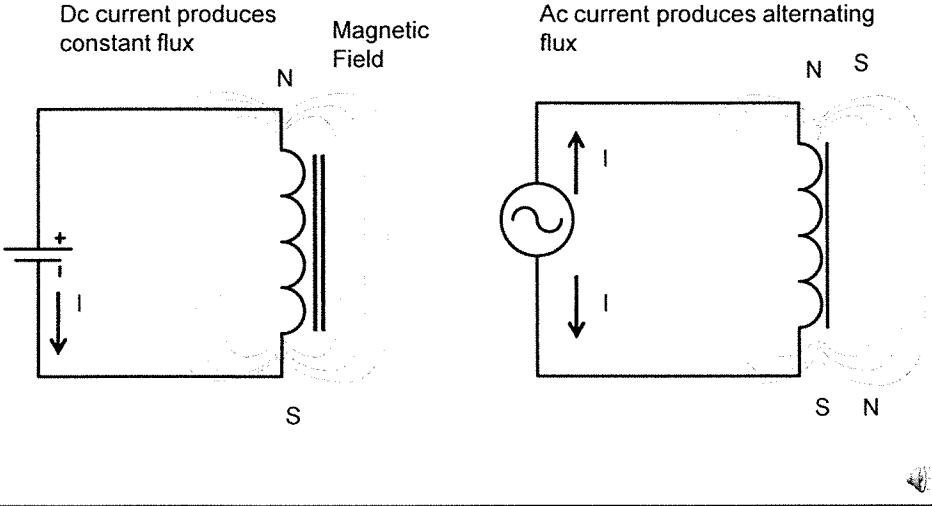
## Electromagnetism

Currents flowing in wires produce magnetic flux

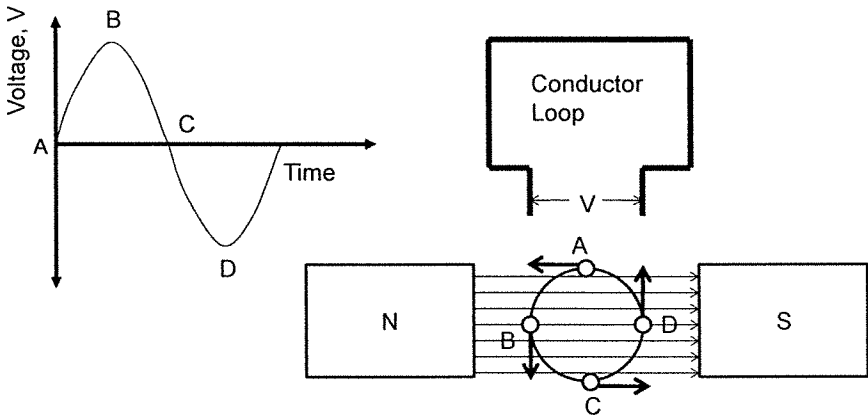


# Electromagnetism

Coiling wire focuses flux



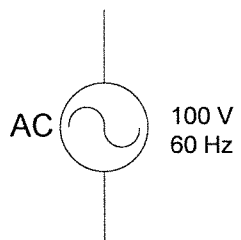
# Induced Voltage Generating Ac Voltage



Rotating a conductor through a magnetic field produces an Ac voltage generators (Alternators)

## Ac Generators

Schematic Symbol for Ac Generators (Alternators)



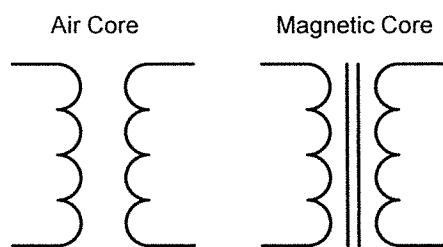
Symbol represents both power generators and small signal devices used in electronics

Must specify voltage and frequency values

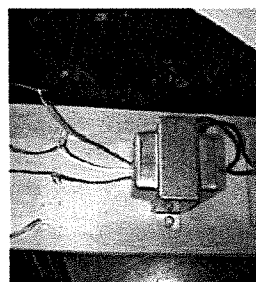


## Magnetic Coupling Transformer Action

Two coils wound on a common magnetic core form a transformer



Schematic Symbols



Iron core transformer 120/12.6 V

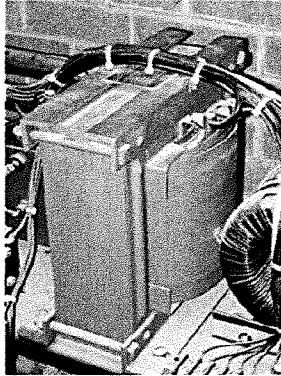
Used to increase and decrease voltage levels in ac systems  
Will not work with dc

Number of turns in coils determine characteristics

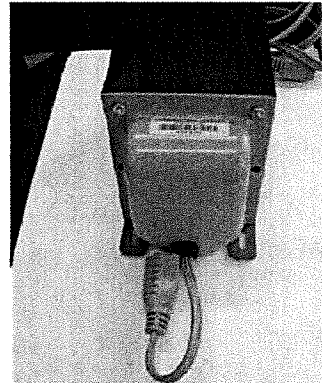


## Transformers

### Power Transformer Applications



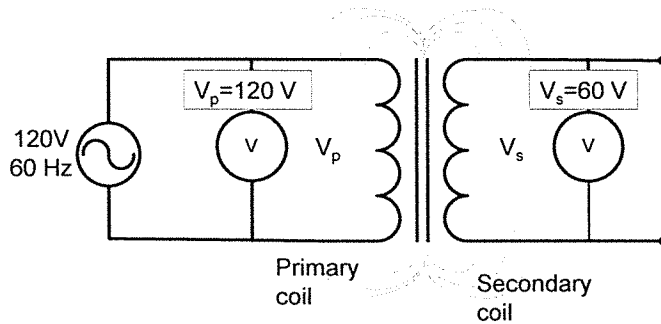
Industrial Power Supply



Bench-top Isolation Transformer

## Transformer Action

Magnetic field produced in primary coil induces voltage in secondary coil

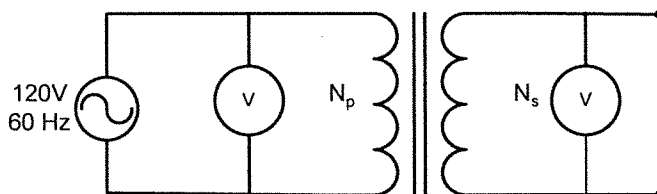


$N_p$  = turns in primary coil  
 $N_s$  = turns in secondary coil  
 $V_p$  = primary voltage applied  
 $V_s$  = secondary voltage induced

$V_s < V_p$  Step-down  
 $V_s > V_p$  Step-up

## Transformer Action

Induced voltage is proportional to number of turns in coils



Equation

$$\frac{N_p}{N_s} = \frac{V_p}{V_s}$$

Example: Given  $N_p = 100$ ,  $N_s = 50$  and  $V_p = 120$  find  $V_s$

$$\frac{N_p}{N_s} = \frac{V_p}{V_s} \quad \frac{100}{50} = \frac{120}{V_s}$$

$$100V_s = 50(120)$$

$$V_s = \left(\frac{50}{100}\right)(120) = 60$$

## Laboratory Dc Power Supplies

Dc Power Supplies – Instruments that produce controllable dc voltages and currents from 120 V Ac outlet voltages

Replace batteries in lab experiments and electronics design

Typical Voltages

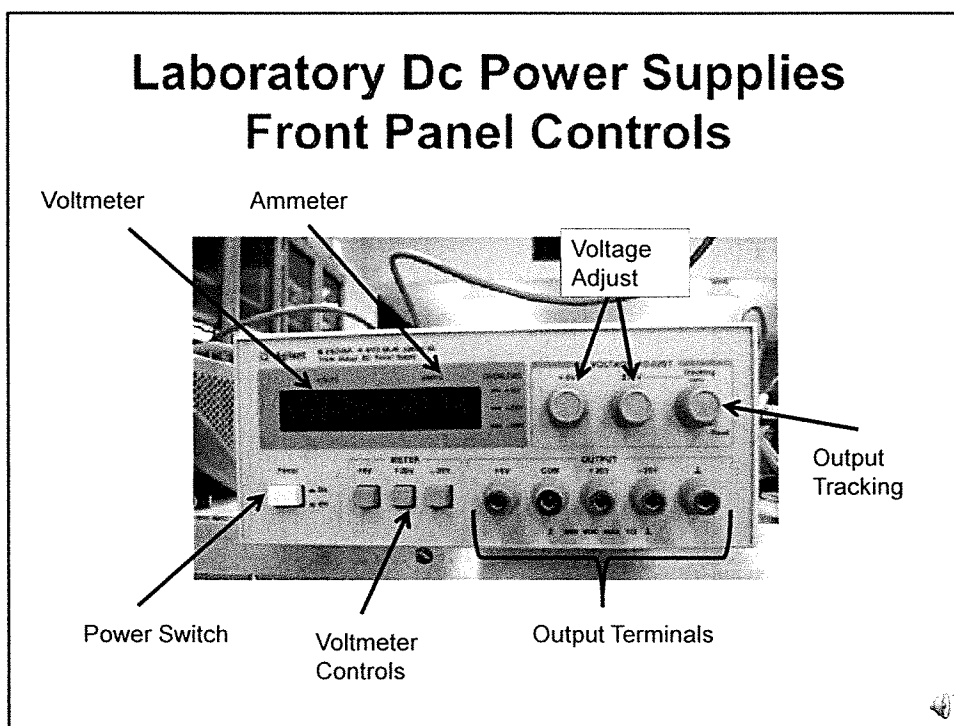
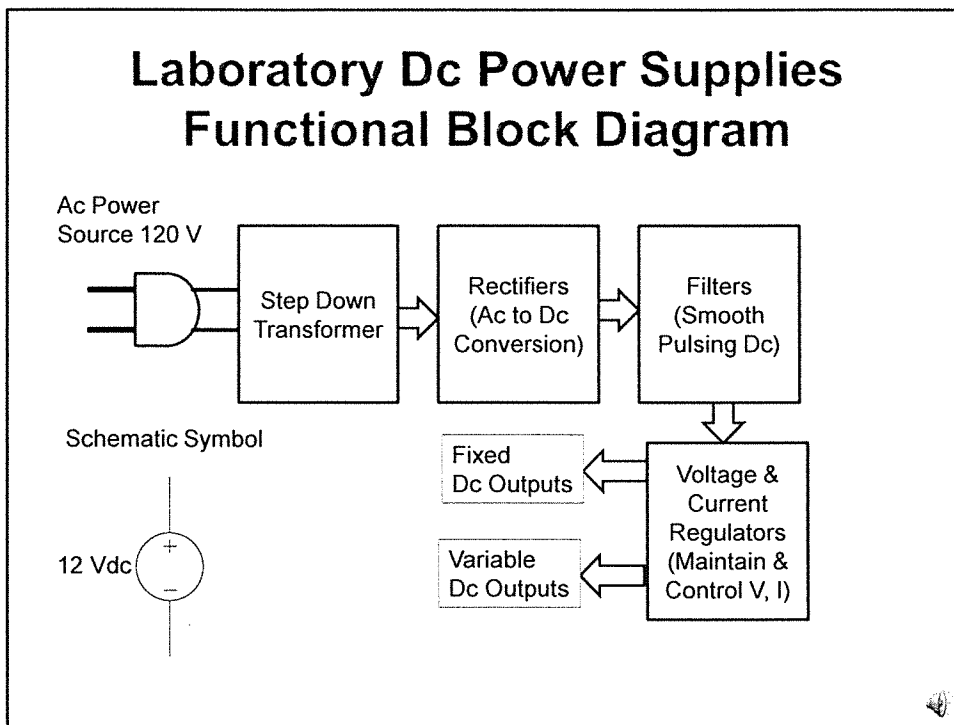
0 -20 V dc

0-30 V dc

5 V dc fixed

Supplies can have single output or  
Multiple outputs

Current limits prevent damage  
to supply or designed circuit



# **Ac Voltage Sources**

End Lesson 5 EET 150

Coming Next: Simple Circuit Analysis  
Using Ohm's Law

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