AC VOLTAGE SOURCES

Lesson 5

EET 150

Ac Sources Learning Objectives

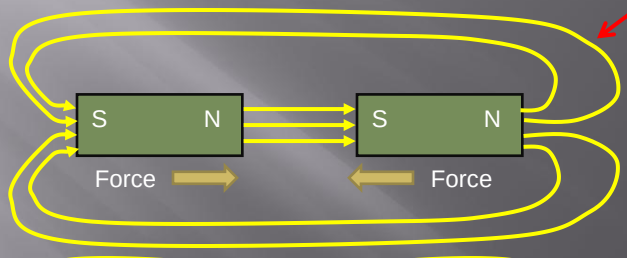
- In this lesson you will:
- learn how magnetic dipoles interact.
- see how electromagnets are constructed
- observe changes in magnetic fields for dc and ac currents
- see how generators create ac voltage
- see how transformers operate
- learn schematic symbols for ac generators and transformers
- study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

Magnetism and Ac Voltage

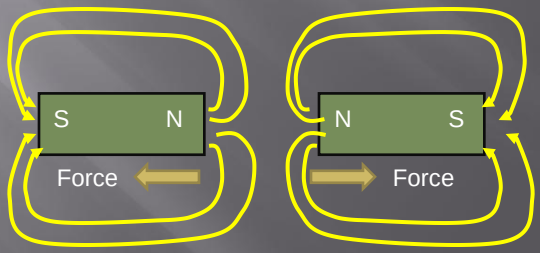
Magnetic fields exert force on objects

Magnetic flux

Opposite Poles Attract

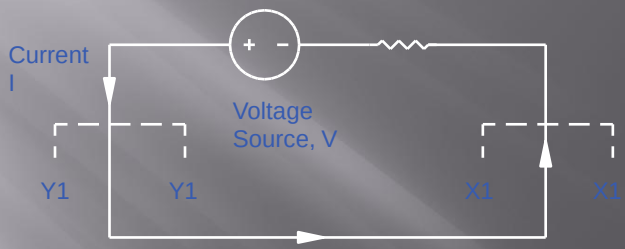


Like Poles Repel



Electromagnetism

Currents flowing in wires produce magnetic flux



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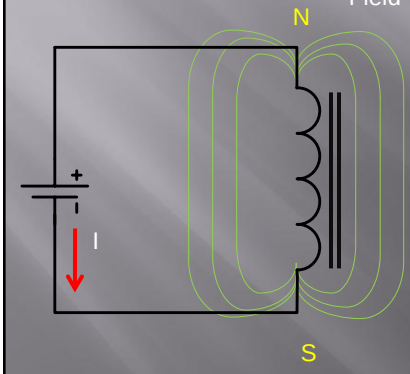
Electromagnetism

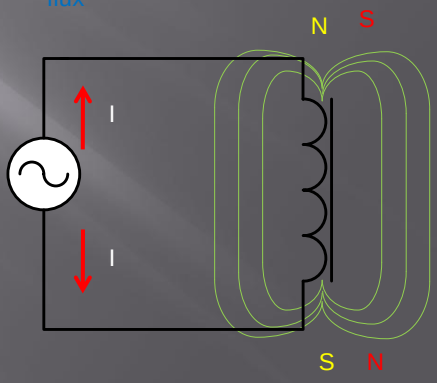
Coiling wire focuses flux

Dc current produces constant flux

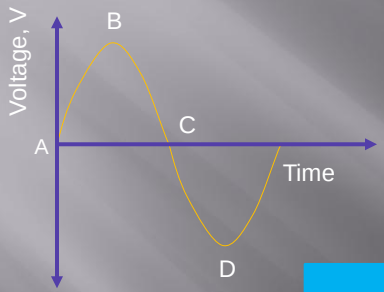
Magnetic Field

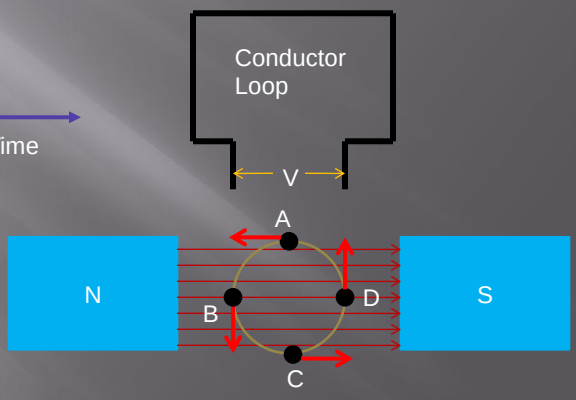


Ac current produces alternating flux



Induced Voltage Generating Ac Voltage

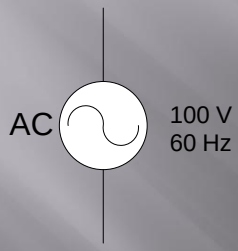




Rotating a conductor through a magnetic field produces an Ac voltage generators (Alternators)

Ac Generators

Schematic Symbol for Ac Generators (Alternators)

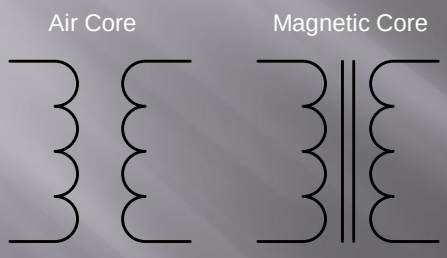


Symbol represents both power generators and small signal devices used in electronics

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

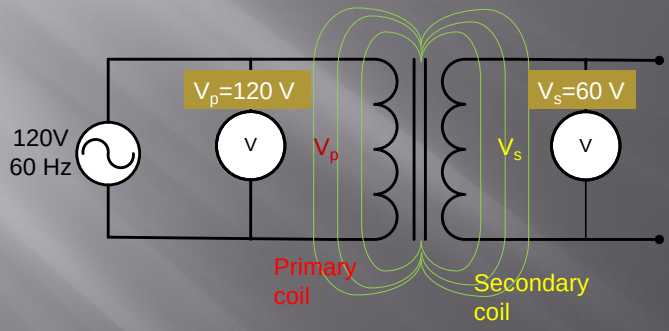
Transfomers
Power Transformer Applications

Industrial Power Supply

Bench-top Isolation Transformer

Transformer Action

Magnetic field produced in primary coil induces voltage in secondary coil

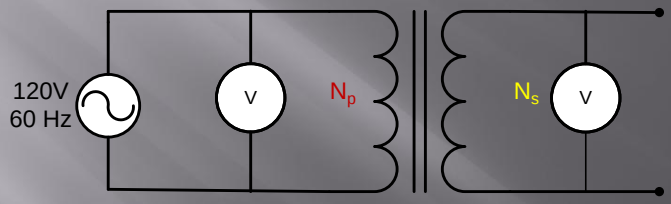


N_p = turns in primary coil
N_s = turns in secondary coil
V_p = primary voltage applied
V_s = secondary voltage induced

$V_s < V_p$ 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

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

$$100\,V_s = 50(120)$$

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

Laboratory Dc Power Supplies

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

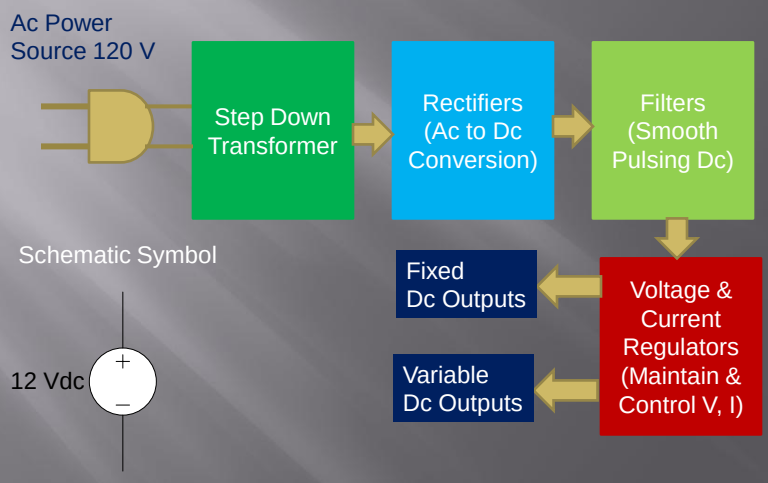
Replace batteries in lab experiments and electronics design

Typical Voltages
0 -20 V dc
0-30 V dc
5 V dc fixed

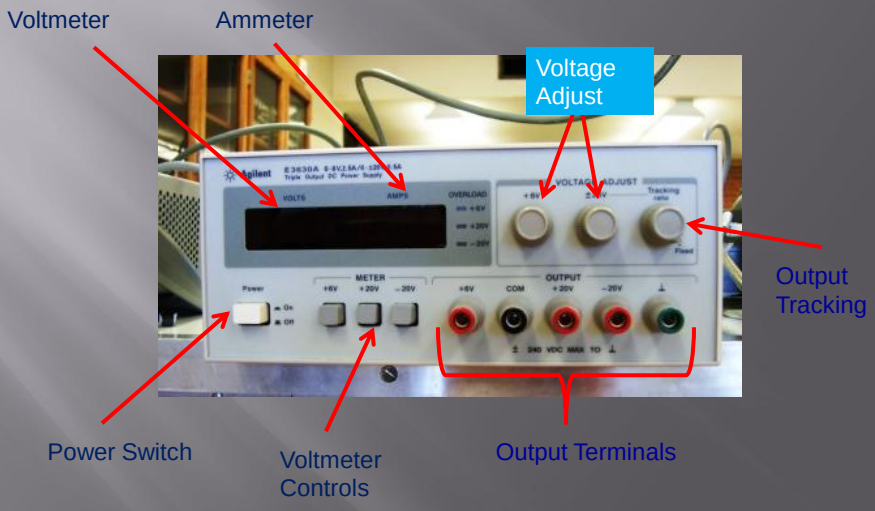
Supplies can have single output or Multiple outputs

Current limits prevent damage to supply or designed circuit

Laboratory Dc Power Supplies Functional Block Diagram



Laboratory Dc Power Supplies Front Panel Controls



Ac Voltage Sources

End Lesson 5 EET 150

Coming Next: Simple Circuit Analysis Using Ohm's Law