ALTERNATING CURRENT

Instantaneous power: $P = IV = \frac{V^2}{R} = I^2R$

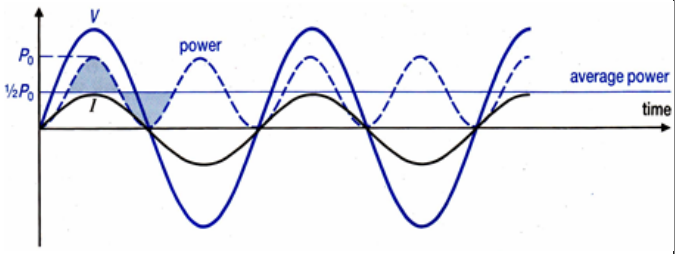
Maximum power: $P_{max} = I_oV_o = \frac{V_o^2}{R} = I_o^2R$

Mean power: $\langle P \rangle = I_{rms}V_{rms} = \frac{V_{rms}^2}{R} = I_{rms}^2R$

R.M.S. values: Different graphs will have different r.m.s functions. General rule to follow:
i) take the square of the instantaneous graph,
ii) find the mean, by find the area under graph divided by time considered,
iii) square-root the answer.

r.m.s. current I_{rms} (and voltage V_{rms}) of the a.c. is same as that of the steady d.c. I_{dc} (and V_{rms}).

Sinusoidal AC (e.g. $I = I_0 \sin \omega t$, $V = V_0 \sin \omega t$)



$I_{rms} = \frac{I_o}{\sqrt{2}}$ and $V_{rms} = \frac{V_o}{\sqrt{2}}$

$\Rightarrow \langle P \rangle = V_{rms} I_{rms} = \frac{V_oI_o}{2} = ½ P_{max}$

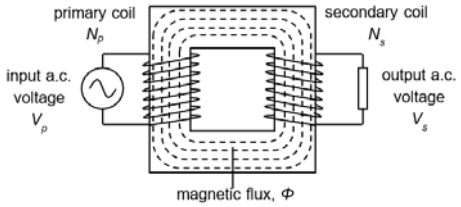
! The above formulae can be used **ONLY for sinusoidal** waveform.

A.C.: Charge carriers periodically reverse their direction of motion.

Transformers (To know how they work based on principles of EMI.)
If no power loss and both coils have the same magnetic flux through them,

Voltage to turns ratio

$$\frac{N_S}{N_P} = \frac{V_S}{V_P}$$



$$I_PV_P = I_S$$

$$\frac{V_P}{V_S} = \frac{I_S}{I_P}$$

Combining the above equations,
For **ideal** transformers:

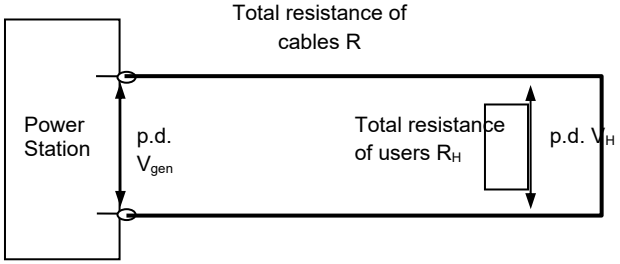
$$\frac{N_P}{N_S} = \frac{V_P}{V_S} = \frac{I_S}{I_P}$$

For step-up transformer, $N_s > N_p \Rightarrow V_s > V_p$.

For step-down transformer, $N_s < N_p \Rightarrow V_s < V_p$

In real life, power loss due to:
i) heating in coil due to resistance and in iron core due to eddy currents
ii) Hysteresis effect due to repeated change in magnetization and demagnetization of core

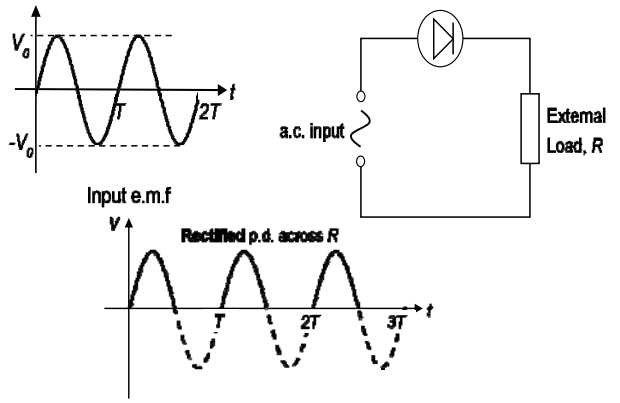
Power losses in transmissions
Power losses in line is mostly due to I^2R losses
For lower power loss, use higher voltage lines.



$I = (P_{gen} / V_{gen})$
$P_{gen} = P_H + P_{loss}$; $V_{gen} = V_H + V_{loss}$
$P_{loss} = I^2R = (P_{gen} / V_{gen})^2 R$

Rectification is conversion of a.c. to d.c.
e.g. using diodes

Half-wave rectification



Output waveform follows the waveform of supply input.