**Integrals applied**

1. *q* = ∫ *i dt*

2) *vc* = (1/C)∫ *i dt*

3) *w =* ∫ *p* *dt*

4) Φ= (*-*1/*N*) ∫ *vind dt*

1. *i =* (*-*1*/L*) ∫ *vind dt*
2. *i*1 = (-1/M) ∫ *v*2 *dt*

**Kirchoff’s Laws Applied**:

1. The current Law.

*The sum of the currents toward any point in a circuit ant any instant equals zero.*

*ig =* C *dv/dt* + (*v/R*) - (1/L*)* ∫*v dt*

1. The voltage Law.

*The sum of the voltage drops around a circuit, at any instant, equals zero.*

*vg = -*L *di/dt* + *Ri* + (1/C) ∫ i *dt*

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1) The current in a circuit was *i =* 4*t*3 amps. How many coulombs were transmitted in 3 seconds?

1. An 80µf capacitor is charged to 100 volts. We then apply a current *ic* = 0.04*t*3 amps in the same polarity as the initial charge. After how many seconds will the capacitor voltage reach 225 volts?
2. The voltage applied to a circuit was *v* = 2*t* +1 volts. If the current followed the equation

*i =* 0.03*t* amperes, find the energy *w* delivered from *t* = 0 to *t* = 50 seconds.

1. A 110 turn winding carries a flux of 0.8 weber. If we now want to vary the flux so that a voltage *vind* = *-*5*t*2 volts appears in the winding, what equation must the flux through the winding follow?
2. A DC current of 0.3 ampere flows in a 15 henry inductor. Superimposed on this DC is a varying current such that the voltage *vind =* 120*t⅓* volts appears in the inductor. Find the instantaneous total current when *t* = 1 second (Assume that the DC and AC currents have the same polarity when *t* = 1 second).

6) An inductance of 8 henrys is connected in series with a 12Ω resistor. Apply to this circuit a voltage *v* = 20*t*2 volts. If *i* = 0 when *t* = 0, find an equation for *i*.

7) If we apply a voltage *v* = 90*t*1/2 to a circuit consisting of a 30 henry inductance shunted by a 50 ohm resistance, what current flows when *t* = 4 seconds? (Let *i* = 0 when *t* = 0).

8) If we apply a voltage *v* = 20*t*4 volts across a parallel *RL* combination, where *R* = 500Ω and *L* = 40 henrys, find the total current when *t* = 0.2 seconds. Let *i* = 4µA when *t* = 0.

9) In a parallel *RL* circuit, *R* = 5Ω and *L* = 0.2 henrys. If a voltage *v* = *t*3/2 + 2 volts were applied, what would the current *i* be when *t* = 4 seconds? Assume *i* = 0.4 amps when

*t* = 0.

10) A current *i* = 0.005*t*1/2 amps flows in a parallel *RC* circuit where *R* = 8.8 x 104 Ω and

*C* = 1µf. Find a formula for the voltage across the circuit as a function of time *t*. Assume the capacitor to be initially discharged.

11) The current function *i* = 1 x 10-3 *t*1/2amperes is applied to a series *RC* circuit where *R* =

8.8 x 104 Ω and *C* = 1 µf. Find a formula for the impressed voltage as a function of time *t*. (Assume the initial capacitor charge to be 100 v.)

12) A series *LC* circuit where *L* = 0.1 henry and *C* = 100 µf has applied to it a current

*i* = 0.1A from *t* = 0 onward. Find (a) the formula for the voltage across the circuit, and (b) the rate of change of the voltage at *t* = 2 sec. (Assume Vc = 0 when *t* = 0).

13) A series circuit has these constants: *R =* 5kΩ, *L* = 200 henrys, and *C* = 20 µf. If we supply to the circuit a current *i* = 0.02*t*2 amperes, at what rate does the voltage across the circuit change when *t* = 0.2 seconds?

14) In a series *RCL* circuit, let *R* = 10Ω, *C* = 10,000µf, and *L* = 10 henrys. Through this circuit we pass a current *i* = 1 - *t*1/2 amps. Find the total voltage *v* across this circuit when *t =* 4 seconds. Assume *v* = 0.25 volts when *t* = 1 second.