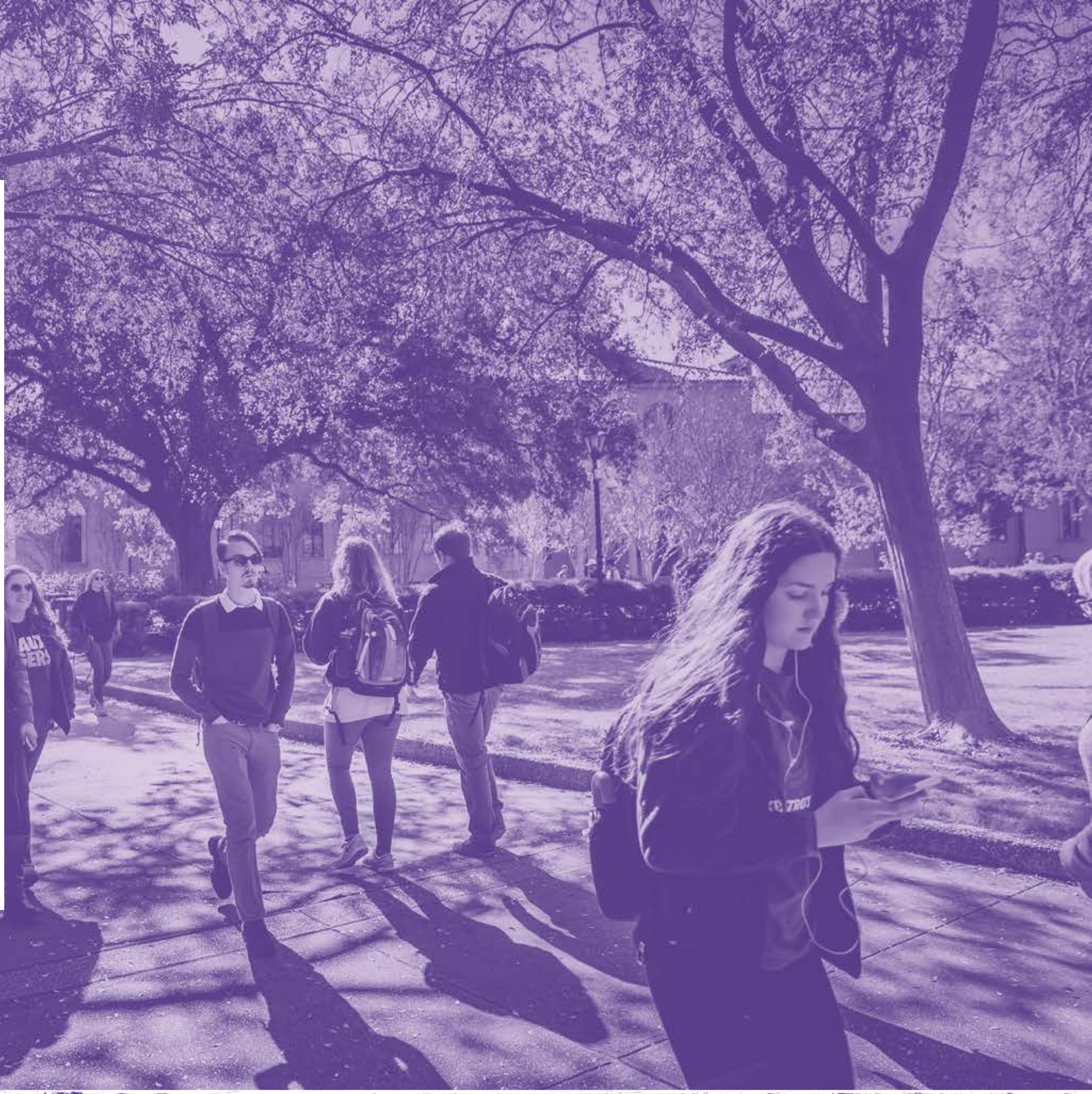
Electrical and Computer Engineering

FE Review



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Topics to Cover in the ECE review for the FE:

- Physics Review Capacitance
- Direct Current
- Resistance
- KVL, KCL
- Charging/Discharging a Capacitor
- Inductance
- Symbols
- Complex Numbers
- AC Circuits
- Complex Power

Mathematics	complex algebra, Laplace transforms, vector	
Probability and Statistics	normal distribution - device tolerances	EE 3150
Ethics and Professional Practice	IEEE Code of Ethics	
Engineering Economics	project management	IE 3201
Properties of Electrical Materials	conductors, semiconductors and insulators	EE 2230, 3232
Engineering Sciences	electrostatics and electrmagnetics	PHYS 2113
Circuit Analysis (DC and AC Steady State)	KCL, KVL	EE 2120, 2130
Linear Systems	Poperties of Linear, time-invariant systems - convolution, modeling, Laplace transform analysis	EE 3610
Signal Processing	continuous and discrete time processing, sampling, Fourier analysis	EE 3160, 3610
Electronics	diodes, op-amps, transistors and applications	EE 3220
Power	3-phase power, power factor and correction, synchronous generator	EE 3410
Electromagnetics	static and dynamic fields, electromagnetic waves, tranmission lines	EE 3320
Control Systems	open loop and closed loop control, feedback systems	EE 3530
Communications	Digital coding of analog information, transmission, modulation, decision theory	EE 4625
Computer Networks	Network topology and architecture, protocal layers, security	EE 3710
Digital Systems	HDL, structural and behavioral models, synthesis, coding strategies for digital circuits	EE 4755

Physics Review:

- Electric Field due to a single charge

$$E = k\frac{q}{r^2} \qquad k = 8.89\text{x}10^9\ \text{Nm}^2/\text{C}^2$$

- Uniform electric field due to a uniform distribution of surface charge (Gauss's law):

$$E = \frac{\sigma}{\epsilon_0} \rightarrow \frac{\text{surface charge density}}{\text{permittivity of free space}}$$

- Electric potential due to a single charge:

$$V = \frac{kq}{r}$$

- Potential difference in uniform electric field:

$$\Delta V = Ed$$

- Potential Energy:

$$\Delta U = q\Delta V$$

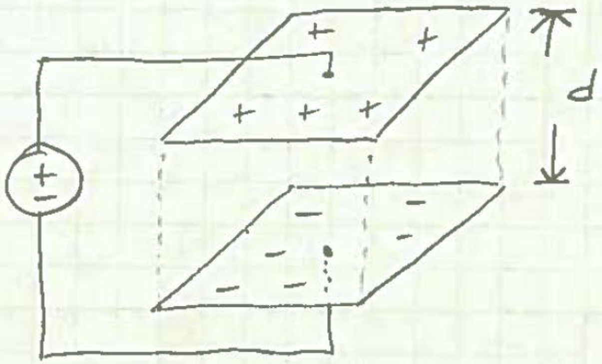
- Charge in a uniform electric field: F = qE qE=ma $q\Delta V = K_f - K_i$

Examples 1,2,3

Capacitance $C = \frac{\varepsilon A}{d}$ (Farads) $C = \frac{Q}{\Delta V}$

PARALLEL PLATE CAPACITOR

CONDUCTING PLATES w/
- AREA A
- SEPARATED BY DISTANCE d
- BETWEEN THE PLATES IS AN INSULATOR.



Energy stored in Capacitance

$$w(t) = \frac{1}{2} C v^2(t)$$

INSULATORS HAVE A MATERIAL PROPERTY THAT ENHANCES ELECTRIC FIELD CAPACITY → ENHANCES CAPACITANCE

PERMITTIVITY ε

MATERIALS ARE COMPARED TO PERMITTIVITY OF FREE SPACE

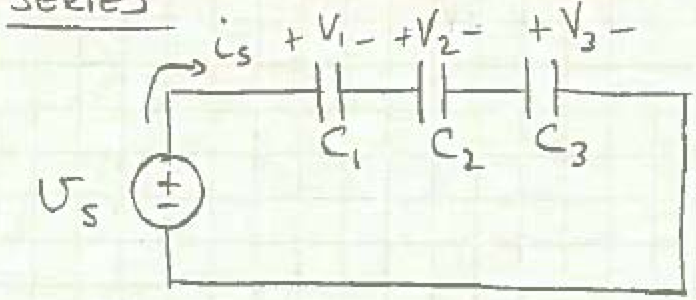
$$\varepsilon_o = 8.85 \times 10^{-12} \text{ F/m}$$

FOR ANY MATERIAL $\varepsilon = \varepsilon_r \varepsilon_o$

$\varepsilon_r \triangleq$ RELATIVE PERMITTIVITY

5-2.2 COMBINATIONS OF CAPACITORS

SERIES



$$i = C\frac{dv}{dt}$$

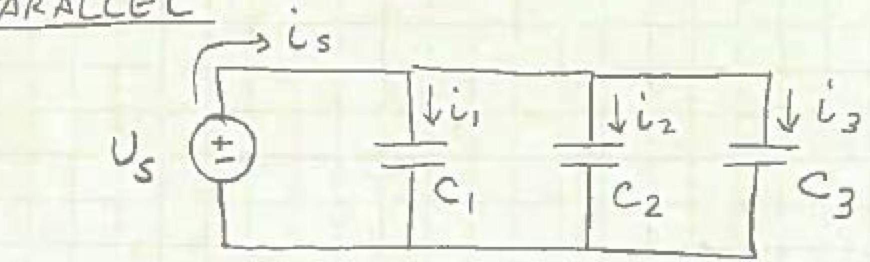
$$V_s = V_1 + V_2 + V_3$$

$$i_s = C_{eq}\frac{dV_s}{dt} = C_{eq}\left(\frac{dV_1}{dt} + \frac{dV_2}{dt} + \frac{dV_3}{dt}\right)$$

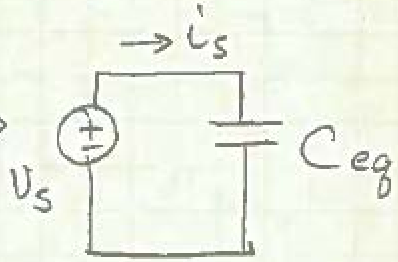
$$i_s = C_{eq}\left(\frac{i_s}{C_1} + \frac{i_s}{C_2} + \frac{i_s}{C_3}\right)$$

$$\boxed{\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}}$$ SERIES

PARALLEL



$\Rightarrow$



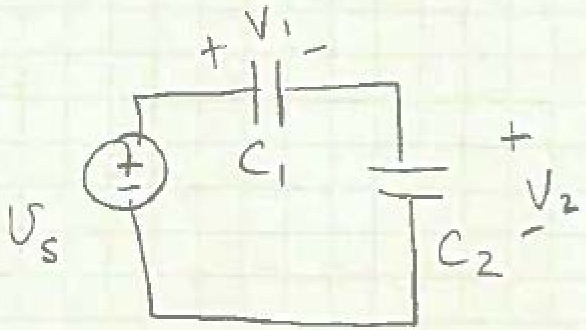
$$i_s = i_1 + i_2 + i_3$$

$$i_s = C_{eq} \frac{dv_s}{dt}$$

$$C_{eq} \frac{dv_s}{dt} = C_1 dv_s + C_2 dv_s + C_3 dv_s$$

$$\boxed{C_{eq} = C_1 + C_2 + C_3}$$

PARALLEL



$$V_1 = V_s \left(\frac{C_2}{C_1 + C_2} \right)$$

$$V_2 = V_s \left(\frac{C_1}{C_1 + C_2} \right)$$

Go to paper lecture notes