Questions after the midterm
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(1) Apply Farady's law in integral form to the area traversed by a travelling plane shown. (2) Simplify the result (evaluate

the integrals) assuming the width is small.

(1) Derive the dispersion relation for the Kein Gordon equation shown. (2) Rewrite this expression using the quantum

relations between energy/frequency and momentum/wavelength.

Using the wavevector notation derive an expression for the fringe spacing between two plane waves as shown and whose phase

is the same at the origin.

Derive equations that result from setting the phases equal for the incident/reflected and incident/transmitted waves in

terms of thetaI, thetaR, and thetaT.

Derive an equation for the perpendicular component of Ei, Er, and Et at the boundary of two linear dielectrics.

F=qE+qvxB. How large is the second term compared with the first for an atomic electron driven by an EM wave?

An EM wave is in a conductor driving the free electrons. We derived J = sigma E (with sigma complex). Why is this not Ohms

law?

Write an equation of motion for a free charge (in a conductor) driven by an oscillating EM wave.

Derive the dispersion relation for a wave moving in a neutral medium with charges free to move.

Given the field distribution in the waveguide, E0(x,y) exp[I(kz-wt)] derive an expression for sigma on the surface.

Derive the wave equation from Maxwell's equation in vacuum. Remember del x del x A = grad div A - laplacian A.

What non trivial approx for E would you use for an EM wave in free space (say after traversing a lens)?

Consider a waveguide made with perfectly conducting walls. Derive an expression for E parallel at the wall/vac boundary.

Justify if the Kirhoff formulation of diffraction work for the Schrodinger equation (a) for a free particle (b) with a

potential?

(a) why can't you use a He-Ne laser to study crytal structure? (b) Why can you see inside a microwave oven and yet little

microwave radiation escapes?

Derive the four constraint equations on a, b, c, d and f from contiuity of the wavefunction and its first derivative.

Write an integral expression a point P for (a) the vector potential from a harmonic current on the z axis and (b) for

huygens principle with a slit along the z axis.