Exam 3

P202 Spring 2009,
Instructor: Prof. Abanov

04/02/09

Name_____________ Section_____________
(print)

517 Labs at 12:40-03:30 pm, TA: Wenlong Yang
518 Labs at 01:50-04:40 pm, TA: Jianping Xiao
519 Labs at 03:00-05:50 pm, TA: Kyle Damborsky
Problem 1.

The series RCL circuit is given on the figure. The source supplies alternating voltage with amplitude $V = 3V$, and frequency $f = 150Hz$. The capacitance of the capacitor is $C = 2.5mF$ and inductance of the inductor is $L = 10mH$ and the resistance $R = 10\Omega$.

What is the amplitude of the current in the circuit?_____

What is the phase angle between the current and the voltage?_____

What average power is supplied by the source?_____

What average power is dissipating on the capacitor and inductor?_____,_____

What average power is dissipating on the resistor?_____

What is the resonance frequency of the circuit?_______
Problem 2.
In the circuit shown in the drawing, the generator supplies the same amount of rms voltage \( V_{\text{rms}} = 15 \text{V} \) at either very small or very large frequencies. The resistance of the resistors are \( R_1 = 5 \text{k}\Omega \), \( R_2 = 3 \text{k}\Omega \).

What current is supplied by the source at very small frequency?______

What power is supplied by the source at very small frequency?______

What current is supplied by the source at very large frequency?______

What power is supplied by the source at very large frequency?______
Problem 3.
A radio station broadcasts at a frequency 630kHz. At some point the magnetic field amplitude of the electromagnetic wave is \(6 \times 10^{-11} T\).

What is the wavelength of the electromagnetic wave?

What is the angular frequency of the electromagnetic wave?

What is the electric field magnitude of the electromagnetic wave?

What is the energy density of the electromagnetic wave at this point?
Problem 4.

A ray of light enters a glass angle ($\theta = 60^\circ$) with $n_g = 1.33$ from the side $a$ at the angle $\alpha = 41.68^\circ$

What is angle $\beta$?______

What is the angle $\gamma$?______

What must $\alpha$ be in order for the ray not to go through the side $b$?
An unpolarized beam of light is incident upon a group of three polarizing sheets which are arranged so that the transmission axis of the sheets are rotated by $\alpha_1 = 30^\circ$ and $\alpha_2 = 90^\circ$ with respect to the vertical.

What fraction of the incident intensity $S_0$ passes through the first polarizer? ______

What fraction of the incident intensity $S_0$ passes through the second polarizer? ______

What fraction of the incident intensity $S_0$ is transmitted? ______
Problem 6.
An object is placed 30.0 cm from a concave spherical mirror with radius of curvature 80.0 cm.

Is the image virtual or real?________

Is the image inverted?________

What is the focal length of the mirror?________

What is the distance from the image to the mirror?________

What is the magnification?_______
Problem 7.
A diver is under water \( n = 1.33 \) in a sunny day. He looks up and sees a diving board which appears to be 3m above the water.

What is the real height of the diving board above the water?

What is the angle of internal reflection?

If the diver is 2m under water what is the radius of the bright circle he sees when he looks up?
Problem 8.
The object is $s=15\text{cm}$ from the first lens. The distance between lenses is $L=20\text{cm}$. The focal length of the first lens is $f_1=10\text{cm}$ and of the second lens it is $f_2=5\text{cm}$.

What is the distance between the first lens and the first image?_____

What is the distance between the second lens and the final image?_____

What is the magnification of the first lens?_____

What is the magnification of the second lens?_____

What is the final magnification?_____

Is the final image virtual?_____

Is the final image inverted?_____

**Problem 9.**

A telescope with the angular magnification 100 has an eye piece lens with focal length 5cm.

**What is the focal length of the objective?**

**What is the distance between objective lens and the eyepiece?**
**Problem 10.**
A far sighted person has a near point at 2m. (A healthy person has a near point at 25cm)

*Does he need convergent or divergent lenses for his glasses?*****

*What should be the focal length of his glasses?*****

*What is the power of those lenses?*****