

Instructor: *P. Kumar*

## PHYSICS DEPARTMENT

PHY 2049

Exam III

July 20, 2009

Name (print, last first): \_\_\_\_\_ Signature: \_\_\_\_\_

*On my honor, I have neither given nor received unauthorized aid on this examination.***YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.****DIRECTIONS**

- (1) **Code your test number on your answer sheet (use 76–80 for the 5-digit number).** Code your name on your answer sheet. **Darken circles completely (errors can occur if too light).** Code your student number on your answer sheet.
- (2) **Blacken the circle of your intended answer completely, using a number 2 pencil.** Do not make any stray marks or the answer sheet may not read properly.
- (3) The answers are rounded off. Choose the closest to exact. There is no penalty for guessing.

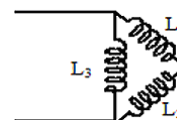
**Table of constants**

$k = \frac{1}{4} \pi \epsilon_0$	$e = 1.6 \times 10^{-19} \text{C}$	$m_e = 9.11 \times 10^{-31} \text{kg}$
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1. A ray of light from medium  $a$ , whose index of refraction is 1.89, enters medium  $b$ . The angle of incidence  $\theta_a$  is  $50^\circ$  and the angle of refraction  $\theta_b$  is  $60^\circ$ . What is the index of refraction of medium  $b$ ?

- (1) 1.7                      (2) 1.4                      (3) 1.3                      (4) 1.2                      (5) 1.5

2. In the Figure  $L_1 = 20$  mH,  $L_2 = 30$  mH, and  $L_3 = 40$  mH. The equivalent inductance (in mH) between the wire ends is:



- (1) 22                      (2) 90                      (3) 9.2                      (4) 40                      (5) 66

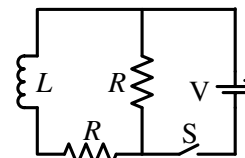
3. The light from a professor's laser pointer can be considered as an electromagnetic plane wave. If the laser beam has 5 mW of power and illuminates a circular spot 2.5 mm in radius on a screen, what is the maximum electric field amplitude ( $E_m$  in N/C) at the screen?

- (1) 440                      (2) 311                      (3) 622                      (4) 550                      (5) none of these

4. A horizontal beam of unpolarized light is incident upon a stack of 4 polarizers with axes of polarization, in order and measured clockwise from the vertical, at  $30^\circ$ ,  $75^\circ$ ,  $120^\circ$  and  $180^\circ$ . What is the ratio of the intensity of the transmitted beam to that of the incident beam?

- (1) 0.031                      (2) 0.063                      (3) 0.023                      (4) 0.047                      (5) 0.0063

5. In the circuit shown,  $L = 45$  mH,  $R = 4.6\Omega$  and  $V = 12.0$  V. The switch S has been open for a long time then is suddenly closed at  $t = 0$ . At what value of  $t$  (in msec) will the current in the inductor reach 1.1 A?



- (1) 5.36                      (2) 8.44                      (3) 2.88                      (4) 19.0                      (5) None of these

6. Refer to the previous problem. What is the total energy stored in the inductor a long time after the switch is closed?

- (1) 0.15 J                      (2) 0.048 J                      (3) 0.76 J                      (4) 0.2 J                      (5) None of these

7. Light traveling horizontally enters a right prism through the hypotenuse, as shown in the Figure. The index of refraction of the prism is  $n = 2$ . At what angle is the light deflected from horizontal?
- (1) none of these                      (2)  $26^\circ$                       (3)  $19^\circ$                       (4)  $45^\circ$                       (5)  $36^\circ$
8. Two identical thin lenses of  $+6$  cm focal lengths are separated by 20 cm. An object lies 11 cm from the first lens. The magnification of the 2 lens system is:
- (1) 9                      (2) 21                      (3) 1.2                      (4) 7.5                      (5) 4.6
9. A car radio uses an LC circuit and a variable capacitor to tune to different radio stations. The value of the capacitance to tune to a radio station of 1000kHz is  $C$ . What must its value be to tune to a station at 200kHz?
- (1) 25C                      (2) 20C                      (3) 15C                      (4) 10C                      (5) 5C
10. An object is placed 6 cm in front of a concave mirror of radius of curvature 20 cm. What is its magnification?
- (1) 2.5                      (2) 1.43                      (3)  $-2.5$                       (4)  $-1.43$                       (5) none of these.
11. An arrangement for generating a traveling electromagnetic wave in the shortwave radio region of the spectrum works as follows: an LC oscillator produces a sinusoidal current in the antenna, which generates the wave, traveling outward at the speed of light. What is the wavelength (in meters) of the wave emitted by this system if  $L = 0.323\mu\text{H}$  and  $C = 45.0$  pF?
- (1) 7.19 m                      (2) 1.14 m                      (3) 719 m                      (4) 114 m                      (5) None of these
12. A charged capacitor and an inductor are connected in series. At time  $t = 0$  the current is zero, but the capacitor is charged. If  $T$  is the period of the resulting oscillations, the next time after  $t = 0$  that the energy stored in the magnetic field of the inductor is a maximum is:
- (1)  $T/4$                       (2)  $T$                       (3)  $T/2$                       (4) none of these                      (5)  $2T$
13. An LC circuit has an inductance of 15mH and a capacitance of 200nF. At one instant the charge on the capacitor is  $0.15\mu\text{C}$ . At that instant the current is changing at the rate of:
- (1) 50A/s                      (2) 0                      (3) 167A/s                      (4) 100A/s                      (5) 500A/s
14. Please make sure that you have inserted your exam code in spaces 76-80 on the scantron sheet. Also that you have put in your name, UF ID and you have signed the scantron sheet at the back.
- (1) I have already done all.  
(2) Please don't bother me, I am taking an exam.  
(3) What is a scantron sheet.  
(4) What is an exam code.  
(5) None of these

THE FOLLOWING QUESTIONS, NUMBERED IN THE ORDER OF THEIR APPEARANCE ON THE ABOVE LIST, HAVE BEEN FLAGGED AS CONTINUATION QUESTIONS: 6