Instructor(s): *F.E. Dunnam*

PHYSICS DEPARTMENT

PHY 2054 2nd Exam 06 July 2004

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.

(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**. Code your UFID number on your answer sheet.
(2) Print your name on this sheet and sign it also.
(3) Do all scratch work anywhere on this exam that you like. **Circle your answers on the test form.** At the end of the test, this exam printout is to be turned in. No credit will be given without both answer sheet and printout with scratch work most questions demand.
(4) **Blacken the circle of your intended answer completely, using a #2 pencil or <u>blue</u> or <u>black</u> ink**. Do not make any stray marks or some answers may be counted as incorrect.
(5) The answers are rounded off. Choose the closest to exact. There is no penalty for guessing. If you believe that no correct answer is listed, **leave this item blank**!!
(6) **Record your exam code;** it will be used to post your score. **Hand in the answer sheet separately.**

Useful (??) Constants:

$\mu_0 = 4\pi \times 10^{-7}$ Tm/A			$\epsilon_0 = 8.85 \times 10^{-12}\text{C}^2/(\text{Nm}^2)$		
electron charge $= -1.6 \times 10^{-19}$C			electron mass $= 9.11 \times 10^{-31}$kg		
V=volt	N=newton	J=joule	m=meter	W=watt	μ = "micro-" $= 10^{-6}$
A = ampere	"pico" $= 10^{-12}$	n = "nano" $= 10^{-9}$	m = "milli" $= 10^{-3}$	proton mass $= 1.67 \times 10^{-27}$ kg	
$c = 3 \times 10^8$ m/s					

1. A transformer is to be designed to increase the 30-kV (rms) output of a generator to the transmission line voltage of 345 kV (rms). If the primary winding has 80 turns, how many turns must the secondary have?

   (1) 920 (2) 6 (3) 70 (4) 9200 (5) none of these

2. In an AC circuit, the ratio of average current to maximum current is:

   (1) 0.707 (2) zero (3) 0.5 (4) 1.0 (5) none of these

3. A transformer consists of a 500-turn primary coil and a 2000-turn secondary coil. If the current in the secondary is 3.00 A, what is the primary current?

   (1) 12.0 A (2) 0.750 A (3) 1.33 A (4) 48.0 A (5) none of these

4. A large jetliner with a wingspan of 40 m flies horizontally and due north at a speed of 300 m/s in a region where the magnetic field of the earth is 60μT directed 50° below the horizontal. What is the magnitude of the induced emf between the ends of the wing?

   (1) 550 mV (2) 250 mV (3) 350 mV (4) 750 mV (5) none of these

5. A flat coil of wire consisting of 20 turns, each with an area of 50 cm^2, is positioned perpendicularly to a uniform magnetic field that increases its magnitude at a constant rate from 2.0 T to 6.0 T in 2.0 s. If the coil has a total resistance of 0.40Ω, what is the magnitude of the induced current?

   (1) 500 mA (2) 70 mA (3) 140 mA (4) 800 mA (5) none of these

6. If a bar magnet is falling through a loop of wire, the induced current in the loop of wire sets up a field which exerts a force on the magnet. This force between the magnet and the loop will be attractive when:

   (1) the magnet is leaving the loop
   (2) the magnet enters the loop
   (3) the magnet is halfway through
   (4) never
   (5) none of these

7. A bar magnet is falling through a loop of wire with constant velocity. The south pole enters first. As the magnet leaves the wire, the induced current (as viewed from above):

   (1) is counterclockwise (2) is clockwise (3) is zero (4) is along the length of the magnet (5) none of these

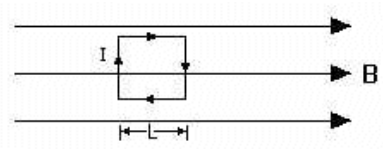
8. A coil with a self-inductance of 0.75 mH experiences a constant current buildup from zero to 10 A in 0.25 s. What is the induced emf during the interval?

   (1) 0.030 V (2) 0.045 V (3) 0.47 V (4) 0.019 V (5) none of these

9. An incredible amount of electrical energy passes down a funnel of a large tornado every second. Measurements taken in Oklahoma at a distance of 9.00 km from a large tornado showed an almost constant magnetic field of 1.50×10^{-8}T associated with the tornado. What was the average current going down the funnel? ($\mu_0 = 4\pi \times 10^{-7}$T·m/A)

   (1) 675 A (2) 450 A (3) 950 A (4) 1500 A (5) none of these

10. There is a current I flowing in a clockwise direction in a square loop of wire that is in the plane of the paper. If the magnetic field B is toward the right, and if each side of the loop has length L, then the net magnetic torque acting on the loop is:



   (1) ILB^2 (2) ILB (3) $2ILB$ (4) zero (5) none of these

11. A stationary positive charge $+Q$ is located in a magnetic field B, which is directed toward the right as indicated in Figure 1 (board). The direction of the magnetic force on Q is

   (1) there is no magnetic force (2) toward the right (3) up (4) down (5) none of these

12. A circular loop carrying a current of 1.0 A is oriented in a magnetic field of 0.35 T. The loop has an area of 0.24 m^2 and is mounted on an axis, perpendicular to the magnetic field, which allows the loop to rotate. What is the torque on the loop when its plane is oriented at a 25° angle to the field?

   (1) 0.076 N·m (2) 4.6 N·m (3) 0.051 N·m (4) 0.010 N·m (5) none of these

13. A proton is released such that its initial velocity is from right to left across the page. The proton's path, however, is deflected in a direction toward the bottom edge of the path due to the presence of a uniform magnetic field. What is the direction of this field?

(1) into the page
(2) out of the page
(3) from the bottom edge of the page
(4) from right to left across the page
(5) none of these

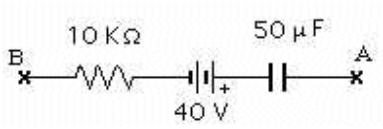
14. The path of a charged particle moving parallel to a uniform magnetic field will be a:

(1) straight line (2) circle (3) ellipse (4) parabola (5) none of these

15. A copper wire of length 25 cm is in a magnetic field of 0.20 T. If it has a mass of 10 g, what is the minimum current through the wire that would cause a magnetic force equal to its weight?

(1) 2.0 A (2) 1.3 A (3) 1.5 A (4) 4.9 A (5) none of these

16. If $I = 2.0$ mA and the potential difference, $V_A - V_B = +30$V in the circuit segment shown, determine the charge and polarity of the capacitor.



(1) 1.5 mC, left plate is positive
(2) 1.5 mC, right plate is positive
(3) 0.50 mC, left plate is positive
(4) 0.50 mC, right plate is positive
(5) none of these

17. See Figure 2 (board). How much current is flowing in one of the 10-Ω resistors?

(1) 0.8 A (2) 2.0 A (3) 1.6 A (4) 2.4 A (5) none of these

18. A 1000-V battery, a 3000-Ω resistor and a 0.50-μF capacitor are connected in series with a switch. The time constant for such a circuit, designated by the Greek letter, τ, is defined as the time that the capacitor takes to charge to 63% of its capacity after the switch is closed. What is the current in the circuit at a time interval of τ seconds after the switch has been closed?

(1) 0.12 A (2) 0.21 A (3) 0.14 A (4) 0.32 A (5) none of these

19. A 10-V-emf battery is connected in series with the following: a 2-μF capacitor, a 2-Ω resistor, an ammeter, and a switch, initially open; a voltmeter is connected in parallel across the capacitor. See Figure 3 (board). At the instant the switch is closed, what are the current and capacitor voltage readings, respectively?

(1) 5 A, zero V (2) zero A, zero V (3) zero A, 10 V (4) 5 A, 10 V (5) none of these

20. A 10-V-emf battery is connected in series with the following: a 2-μF capacitor, a 2-Ω resistor, an ammeter, and a switch, initially open; a voltmeter is connected in parallel across the capacitor. See Figure 3 (board). After the switch has been closed for a relatively long period (several seconds, say), what are the current and capacitor voltage readings, respectively?

(1) zero A, 10 V (2) zero A, zero V (3) 5 A, zero V (4) 5 A, 10 V (5) none of these