NAME:

PHYS 2326 University Physics II – Class number

EXAM – 3, AUGUST-1, 2013
CHAPTERS: 32,33,34,35

Chapter-32

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1. When a switch is closed, completing an *LR* series circuit, the time needed for the current to reach three-quarters its maximum value is _____ time constants.

   a. 0.500
   b. 0.693
   c. 0.725
   d. 1.33
   e. 1.38

2. SAME-PROBLEM. When a switch is closed, completing an *LR* series circuit, the time needed for the current to reach three-quarters its maximum value is _____ time constants.

   a. 0.500
   b. 0.693
   c. 0.725
   d. 1.33
   e. 1.38

---------- Chapter-33 ----------

3. A high-voltage powerline operates at 500 000 V-rms and carries an rms current of 500 A. If the resistance of the cable is 0.050Ω/km, what is the resistive power loss in 200 km of the powerline?

a. 250 kW
b. 500 kW
c. 1 Megawatt
d. 2.5 Megawatts
e. 250 Megawatts

4. At what frequency will a 12-μF capacitor have a reactance X_C = 300Ω?

a. 44 Hz
b. 88 Hz
c. 176 Hz
d. 352 Hz
e. 278 Hz

5. The voltage 8.00 sin (400t) is applied to a series RLC circuit, with R = 200Ω, L = 0.100 H, and C = 1.00 μF. What are the impedance Z and the phase angle θ?

a. 200 Ω, –37°
b. 566 Ω, +87°
c. 2470 Ω, –85.4°
d. 2540 Ω, –88.8°
e. 393 Ω, –63°

6. A current I = 3 sin (400 t) amperes flows in a series RL circuit in which L = 1 mH and R = 100Ω. What is the average power loss?

a. 225 W
b. 450 W
c. 980 W
d. 1.12 kW
e. 900 W

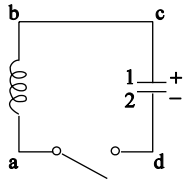
7. A primary current of 6 A exists in an ideal iron-core transformer at a primary voltage of 100 volts. If the current in the secondary is 0.75 A, calculate the output voltage.

a. 12.5 V
b. 40 V
c. 400 V
d. 800 V
e. 200 V

8. A 60-Hz ac generator with a peak voltage of 110 V drives a series *RC* circuit with $R = 10.0\,\Omega$ and $C = 300\,\text{mF}$. The power factor, $\cos\phi$ is

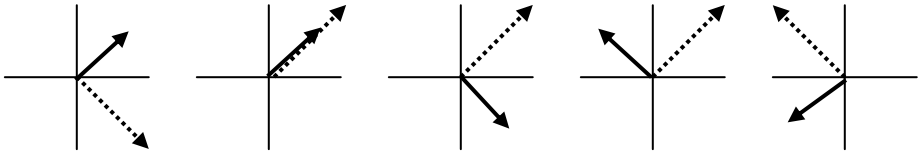
a. –1.00.
b. –0.749.
c. +0.749.
d. +0.834.
e. +1.00.

9. A 10-μF capacitor in an *LC* circuit made entirely of superconducting materials ($R = 0\,\Omega$) is charged to 100 μC. Then a superconducting switch is closed. At t = 0 s, plate 1 is positively charged and plate 2 is negatively charged. At a later time, $V_{ab} = +10V$. At that time, V_{dc} is



a. 0 V.
b. 3.54 V.
c. 5.0 V.
d. 7.07 V.
e. 10 V.

BONUS: The graphs below represent current and voltage phasors at one instant of time. The solid arrows represent the voltage phasors, ΔV_{max}, and the dashed arrows represent the current phasors, I_{max}.The graph which shows the correct relationship between current and voltage phasors for a capacitoror in an *RC* circuit is



a. **b.** **c.** **d.** **e.**

10. Whenever the alternating current frequency in a series *RLC* circuit is halved,

a. the inductive reactance is doubled and the capacitive reactance is halved.
b. the inductive reactance is doubled and the capacitive reactance is doubled.
c. the inductive reactance is halved and the capacitive reactance is halved.
d. the inductive reactance is halved and the capacitive reactance is doubled.
e. the reactance of the circuit remains the same.

---------- chapter-34----------

11. How much electromagnetic energy is contained in each cubic meter near the Earth's surface if the intensity of sunlight under clear skies is 1000 W/m^2?

a. 3.3×10^{-6} J
b. 3.3 J
c. 0.003 J
d. 10^{-4} J
e. 3.0×10^{5} J

12. What is the maximum radiation pressure exerted by sunlight in space (S = 1350 W/m^2) on a flat black surface?

a. 2.25×10^{-5} Pa
b. 0.06 Pa
c. 7×10^{-4} Pa
d. 4.5×10^{-6} Pa
e. 9.0×10^{-6} Pa

13. The magnetic field of a plane-polarized electromagnetic wave moving in the z-direction is given by $B = 1.2 \times 10^{-6} \sin\left[2\pi\left(\frac{z}{240} - \frac{t \times 10^7}{8}\right)\right]$ in SI units. Find the average power per square meter carried by the EM wave.

a. 720 W
b. 172 W
c. 500 W
d. 2×10^7 W
e. 86 W

14. An open circuit consists of a $12\ \mu$F parallel plate capacitor charged to 200 V and a $10\ \Omega$ resistor. At the instant when a switch closes the circuit (with no battery in it) the displacement current between the plates of the capacitor is

a. $1.2\ \mu$A .
b. 2.4×10^{-4} A .
c. 2.4 mA.
d. 10 A.
e. 20 A.

BONUS: Find the frequency of X-rays of wavelength 1 Å = 10^{-10} m.

a. 3×10^{18} Hz
b. 3×10^{10} MHz
c. 6×10^9 Hz
d. 3×10^8 Hz
e. 3×10^{20} Hz

---------- chapter-35 ----------

15. An experiment to measure the speed of light uses an apparatus similar to Fizeau's. The distance between the light source and the mirror is 10 m, and the wheel has 800 notches. If the wheel rotates at 9000 rev/s when the light from the source is extinguished, what is the experimental value for c (in m/s)?

a. 2.94×10^8
b. 2.92×10^8
c. 2.88×10^8
d. 2.98×10^8
e. 3.01×10^8

16. The speed of light changes when it goes from ethyl alcohol (n = 1.361) to carbon tetrachloride (n = 1.461). The ratio of the speed in carbon tetrachloride to the speed in ethyl alcohol, v_2/v_1, is

a. 1.99
b. 1.07
c. 0.93
d. 0.51
e. 0.76

17. Light strikes a diamond (n = 2.42) immersed in glycerin (n = 1.473) at an angle of 60° relative to the normal to the surface. What is the angle of refraction?

a. 20°
b. 60°
c. 32°
d. 64°
e. 15°

BONUS: Light can exhibit the characteristics of

a. a particle with energy $E = hf$.

b. a wave with wavelength $\lambda = \frac{hc}{E}$.

c. a particle or wave that travels at speed $c = 3.00 \times 10^8 \ \frac{\text{m}}{\text{s}}$ in all materials.

d. all of the above.

e. only (a) or (b) above.

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VECTOR PRODUCT:

Each vector can be defined as the sum of three orthogonal components parallel to the standard basis vectors:

$$\mathbf{u} = u_1\mathbf{i} + u_2\mathbf{j} + u_3\mathbf{k}$$
$$\mathbf{v} = v_1\mathbf{i} + v_2\mathbf{j} + v_3\mathbf{k}$$

Matrix notation

The cross product can also be expressed as the formal determinant:

$$\mathbf{u} \times \mathbf{v} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ u_1 & u_2 & u_3 \\ v_1 & v_2 & v_3 \end{vmatrix}$$

This determinant can be computed using Sarrus' rule or cofactor expansion. Using Sarrus' rule, it expands to

$$\mathbf{u} \times \mathbf{v} = (u_2v_3\mathbf{i} + u_3v_1\mathbf{j} + u_1v_2\mathbf{k}) - (u_3v_2\mathbf{i} + u_1v_3\mathbf{j} + u_2v_1\mathbf{k}).$$

Using cofactor expansion along the first row instead, it expands to

$$\mathbf{u} \times \mathbf{v} = \begin{vmatrix} u_2 & u_3 \\ v_2 & v_3 \end{vmatrix}\mathbf{i} - \begin{vmatrix} u_1 & u_3 \\ v_1 & v_3 \end{vmatrix}\mathbf{j} + \begin{vmatrix} u_1 & u_2 \\ v_1 & v_2 \end{vmatrix}\mathbf{k}$$

which gives the components of the resulting vector directly.