

# PHYSICS – 201

## 1<sup>st</sup> Major Examination (Term 031)

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Student's Name \_\_\_\_\_ ID # \_\_\_\_\_  
\_\_\_\_\_ Sec \_\_\_\_\_

- The current in a large solenoid varies according to  $I(t) = 40 + 6.0 t^2$  A. The solenoid has 800 turns/m and a radius of 2.0 cm. At  $t = 2.0$  s. Find the magnitude of the induced electric field at the following distances from the central axis:
  - 0.50 cm,
  - 4.0 cm
- A flat coil of radius 4 cm has 30 turns and a resistance of  $0.15 \Omega$ . It lies with its plane normal to the lines of a uniform magnetic field. The field varies with time such that the power dissipated is 0.4 W. What is the rate of change of the magnetic field?
- When the current in an inductor changes at 128 A/s, the self-induced emf is 12 V. What is the self-inductance?
- In Fig. 1, S2 is open and S1 is closed at  $t = 0$ .
  - what is the initial rate of change of the current ?
  - at what time does this rate drop to 50% of the initial value ?
- A capacitor  $C = 10 \mu\text{F}$  has an initial charge of  $60 \mu\text{C}$ . It is connected across an inductor  $L = 8 \text{ mH}$  at  $t = 0$ .
  - What is the frequency of oscillation?
  - What is the maximum current through L?
  - What is the first time at which the energy is equally shared by C and L ?
- In a RLC series circuit  $R = 50 \Omega$ ,  $C = 80 \mu\text{F}$  and  $L = 30 \text{ mH}$ . The 60 Hz source has an rms potential difference of 120 V. Find:
  - the rms current and potential for each element
  - the power factor
  - the rms power delivered by the source
  - the resonance frequency
  - the peak values of current and potential difference for each element at the resonance frequency

7. A step down transformer has 600 V across the primary and 120 V across the secondary. The secondary has 80 turns
- what is the number of turns in the primary
  - if a load resistor  $R_L = 10 \Omega$  in the secondary, what is the primary current ?
8. A plane EM wave of frequency 25 MHz travels in free space along the + Z direction. At a particular point in space and time  $E = -5 \hat{i}$  V/m. What is B at this point (magnitude and direction)
9. The average energy density in a sinusoidal EM wave is  $10^{-7}$  J/m<sup>3</sup>. Find the magnitude of:
- the electric field
  - the magnetic field
10. A solar panel converts sunlight into electrical energy with an efficiency of 18 %. The intensity of the sun's radiation at the earth surface is 1 KW/m<sup>2</sup>. What is the area needed to generate 10 KW of electrical energy?
11. Green light traveling in glass ( $n = 1.5$ ) emerges into air at  $40^\circ$  to the normal to the glass-air boundary. The wavelength in air is 546 nm.
- What is the angle of incidence in the glass?
  - What is the frequency of this green light in glass?
12. A ray traveling in a transparent medium suffers total internal reflection at its interface with water ( $n = 1.33$ ). The critical angle is  $68^\circ$ . What is the speed of light in this medium?