

PHY114 S09 MidTerm Exam 3

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12:30 pm to 1:45 pm

Please write your workshop number and your workshop leader's name at the top of your answer book.

Each of the four questions counts 25 points, with points distributed among the parts as indicated.

Derive a formula for the answer before you put in the numbers. This will help you to get partial credit if your final numerical answer is wrong.

Put a box around your final answer for each question.

Give answers to two significant digits.

The speed of light in the vacuum is $3.00 \times 10^8 m/s$

1. A gold ring of diameter 1.9 cm is in a 0.76 T magnetic field perpendicular to its plane. In 0.43 seconds the magnetic field is reduced to zero.
 - (a) What is the magnitude of the average induced emf? 15 points
 - (b) If the ring has a resistance of $58 \mu\Omega$, what is the average current in the ring? 10 points
2. A 4100 pF capacitor is connected in series to a $21.2 \mu\text{H}$ inductor.
 - (a) What is the frequency of this circuit? 15 points
 - (b) If you add a resistance in series, will this frequency increase or decrease? 2 points
 - (c) What resistance should be added in series to the circuit to change its frequency by 1%? 8 points
3.
 - (a) How far from a converging lens with a focal length f should an object be placed to produce a real image which is the same size as the object? 10 points
 - (b) Some rearview mirrors produce images of cars behind you that are smaller than they would be if the mirror were flat. Are the mirrors concave or convex? What is a mirror's focal length if cars 21.0 m away appear 0.30 times their normal size? 15 points
4.
 - (a) If the magnetic field in a traveling EM wave has a peak magnitude of 11.5 nT, what is the peak magnitude of the electric field? If its frequency is $2.8 \times 10^{10} \text{ Hz}$ what is the wavelength in vacuum? 15 points
 - (b) A model-train transformer plugs into 110 V AC and draws 0.23 A while supplying 6.8 A to the train. What voltage is present across the tracks? If its primary coil has 828 turns, how many turns should the secondary coil have? 10 points