**PHYS 220: ELECTRICITY & MAGNETISM II CAT 1**

**QUESTION ONE**

1. How is it economical to transmit electrical energy over long distances at high voltage (**2 marks**)
2. From Faraday’s law of induction, state any three ways of inducing emf into a conductor (4 **marks**)
3. A coil consists of 200 turns of wire. Each turn is a square of side *d=* 18 cm, and a uniform magnetic field directed perpendicular to the plane of the coil is turned on. If the field changes linearly from 0 to 0.50 T in 0.80 s, what is the magnitude of the induced emf in the coil while the field is changing?(4 mks)
4. A loop of wire enclosing an area *A* is placed in a region where the magnetic field is perpendicular to the plane of the loop. The magnitude of varies in time according to the expression where *a* is some constant. That is, at *t=*0, the field is , and for t>0 the field decreases exponentially. Find the induced emf in the loop as a function of time. (3 **marks**)
5. The coil in an AC generator consists of 108 turns of wire, each of area *A=* 0.81m2, and the total resistance of the wire is 12.0 V. The coil rotates in a 0.500 T magnetic field at a constant frequency of 50.0 Hz. What is the maximum induced current in the coil when the output terminals are connected to a low-resistance conductor? (**3 marks**)
6. A motor contains a coil with a total resistance of 10 Ώ and is supplied by a voltage of 120 V. When the motor is running at its maximum speed, the back emf is 50 V. Find the current in the coil at the instant the motor is turned on and when it reaches its maximum speed. (**4 marks**)

**QUESTION TWO**

1. Explain one application of electromagnetic induction and eddy currents (**2 marks**)
2. An RLC circuit consists a battery of emf 12.0V and inductor of 2.81 mH connected in parallel with a capacitor of 18.0 pF. The circuit oscillates between the capacitor and inductor.
3. Find the frequency of oscillation of the circuit (3 **marks**)
4. What is the maximum values of charge on the capacitor and hence current in the circuit
5. **marks**)
6. The voltage output of an AC source is given by the expression where is in volts*.* Find the rms current in the circuit when this source is connected to a 100 Ώ resistor. (**3 marks**)
7. A series RLC circuit for which R=150 Ω, L=20.0 mH, ΔVrms=20.0 V, and ω=5000 s-1. Determine the value of the capacitance for which the current is a maximum. (**4 marks**)
8. The input to the primary coil of a transformer is 120 V while the current in the secondary coil is 0.1 A. When 60.0 W of power are delivered to the circuit attached to the secondary coil

i. What is the voltage across this coil? (**3 marks**)

ii. If the primary coil has 20 turns, how many does the secondary coil have? (**3 marks**)

1. A series RLC circuit has R=425 Ώ, L=2.5 H, and C=3.5 μF. It is connected to an AC source with frequency 60 Hz and . Determine the inductive reactance, the capacitive reactance, and the impedance of the circuit and the maximum current in the circuit (4 **marks**)

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