Uva Wellassa University, Sri Lanka
B.Tech. Degree Programme - 2006/07
End Semester Examination- Semester 2
June -2008

PHY221-2 Applied Electricity

Answer Any Four (4) Questions

Time: Two (02) Hours

1. Discuss the importance of using high voltage (kV) power line, when transmitting power to long distance from the power generator.

   Electric power is supplied by a power house for a certain town by using a single-phase 220V AC, two wire system. When the demand is maximum, the voltage supplied to the town drops to 170V. Show that the voltage supplied to the town always remains more than 215V by replacing 220V supply to 11kV high voltage, using the same conductors.

2. Derive the relationship between line and phase quantities in

   (i) star-connected and

   (ii) delta-connected circuit.

   A 3-phase, 400V, star connected alternator supplies a 3-phase, 112kW mesh-connected induction motor of efficiency and power factor 0.88 and 0.86 respectively. Find the current

   (a) in each motor phase

   (b) in each generator phase and

   (c) active and reactive components of current in each case.

3. State the Amperes law in electromagnetism.

   A long coaxial cable consists of two concentric conductors with the dimensions shown in Fig.1. There are equal and opposite currents i in the conductors.

   (i) Determine the magnetic field $B(r)$ at distance r from the axis for

   (a). $r < a$ *(within the inner conductor)*,

   (b). $a < r < b$ *(between the two conductors)*,

   (c). $b < r < c$ *(within the outer conductor)*,

   (d). $r > c$ *(outside the cable)*

(ii) Sketch the variation of $B(r)$ from $r = 0$ *to* $r \to \infty$

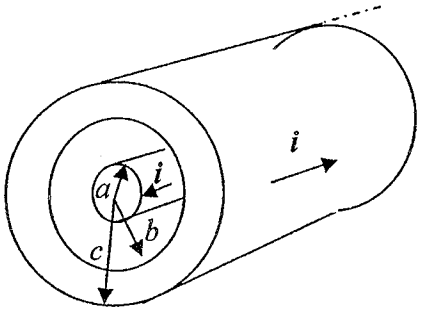

Fig.1

4. A current $I = I_m \sin \omega t$ is flowing through a coil of self inductance L and ohmic resistance R. Obtain an expression for the total applied voltage E as a ***sine*** function and show that the average power input to the coil is given by $P = EI \cos \theta$, where $\theta = \tan^{-1}\left(\frac{\omega L}{R}\right)$.

   A mercury lamp of 500W is operating with a choke coil connected to the 230V, 50Hz power supply. If the mercury lamp draws 5A and the total resistance of the circuit is 22Ω.

   Find (a). the resistance of mercury lamp,

   (b). inductance of the coil,

   (c). input average power.

   A 39.8μF capacitor is now placed in series with the coil. Find the new power factor angle. Does the supply voltage leads or lag to the current?

5. Explain what is meant by the terms "resonant frequency" and the "band width" of a tuned circuit.

   Find the resonance frequency f_r of a **LCR** series circuit in terms of L and C.

   If the lower and upper half power frequencies of the above circuit are f_1 and f_2 respectively, show that $f_r = \sqrt{f_1 f_2}$ and $f_2 - f_1 = \frac{R}{2\pi L}$.

   The half power frequencies and capacitance of such a circuit are 195 kHz, 205 kHz and 0.01μF.

   Determine the ohmic resistance and the self-inductance.

   What is the quality factor of the circuit?